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SCIENTIFIC AMERICAN

April 1, 1916

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SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CXIV.]
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NEW YORK, APRIL 1, 1916

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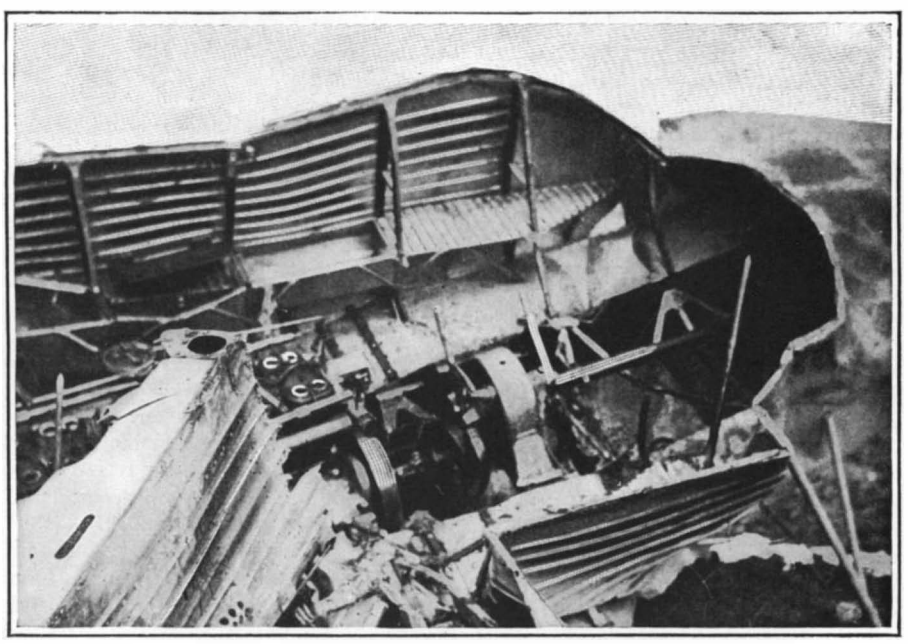
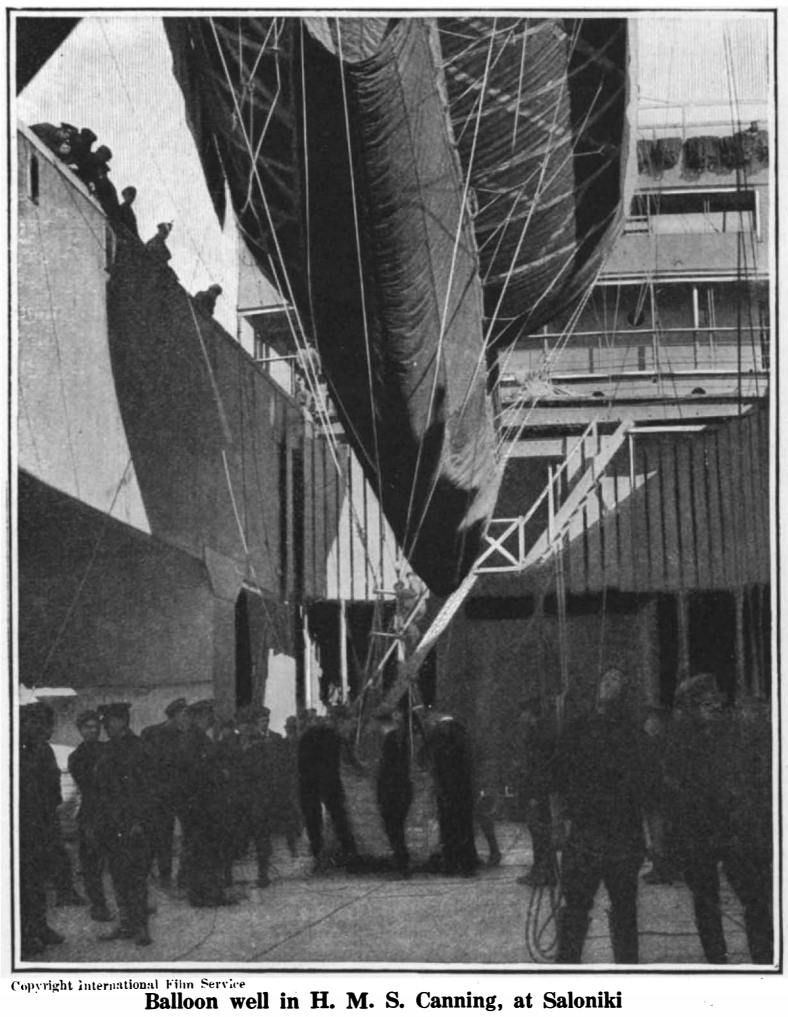
Wreck of a Zeppelin brought down at Brabant-le-Roi near Verdun



Nearer view of the Zeppelin wreck, showing one of the motors

Austrian infantryman cutting barbed wire entanglements

French miniature train taking provisions to the trenches



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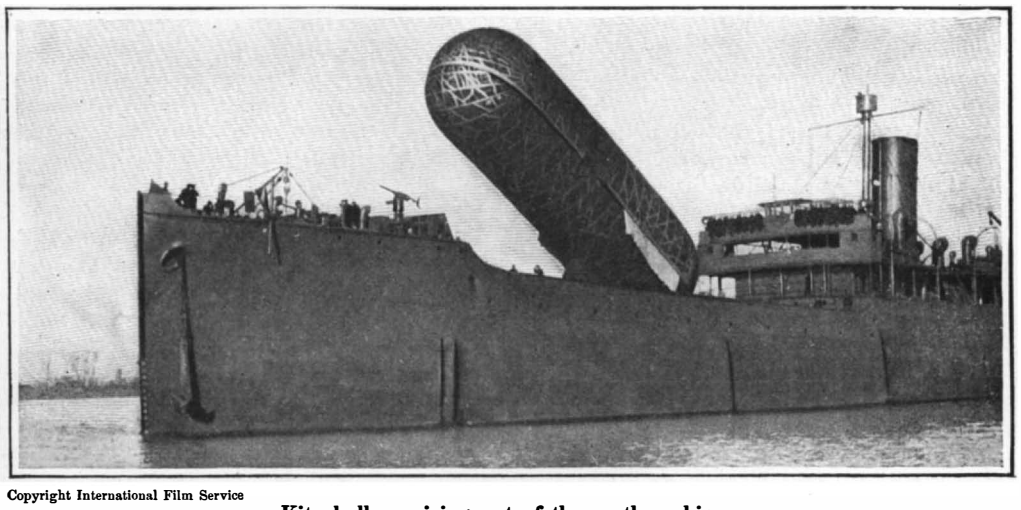
Balloon well in H. M. S. Canning, at Saloniki



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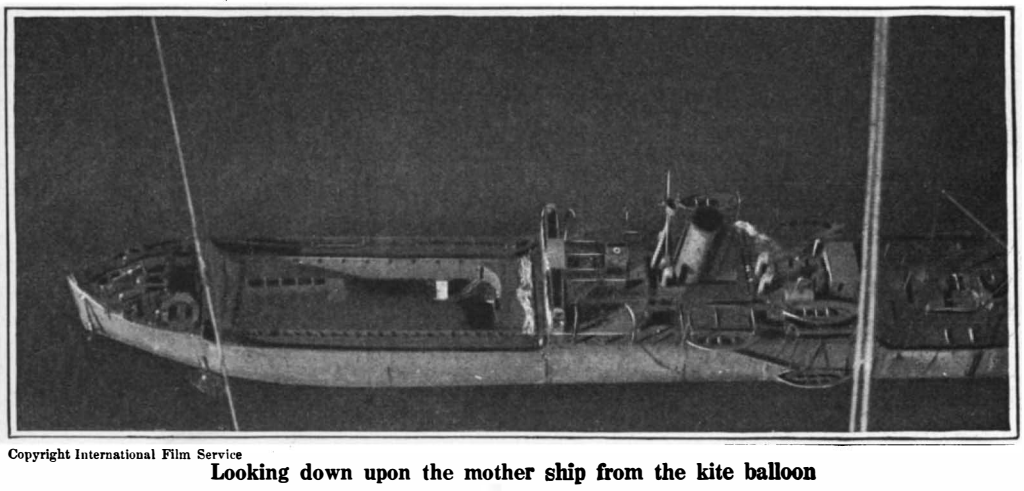
Kite balloon rising out of the mother ship



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Looking down upon the mother ship from the kite balloon

GLIMPSES OF THE VARIED ACTIVITIES OF EUROPE'S FIGHTING MEN

SCIENTIFIC AMERICAN

Founded 1845

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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.

Our Naval Secretary

ALL is not well with the Navy. Of this fact those of us who make a careful study of naval affairs have long been convinced; and to-day the country at large is thinking or saying the same thing. We have some of the finest battleships and destroyers afloat, and a personnel that is second to none. Having said this, we have said about everything that is to the good; for outside of our ships and men (pitifully inadequate in numbers) there is not much that we can point to with pride, as an exhibit of preparedness and efficiency.

There are many weak spots in the Navy Department, and it is a most lamentable and disconcerting fact that one of the weakest of all is to be found in the administrative unfitness of the very head of the Navy—the Secretary himself.

With the possible exception of the position of Secretary of State, there is no public office that calls for a man of such all-round ability, experience, breadth of outlook and tactfulness as that of Secretary of the Navy. Unfortunately, it is in these very qualities that the present Secretary is lacking. And in saying this we would have it clearly understood that we entertain the kindliest feeling and a very sincere respect for Mr. Daniels, the man. He is kindly, earnest, hard-working, and, we believe, is sincerely desirous of furthering the interests of the Navy—so far as he can do so consistently with his inborn prejudices and his ineradicable conception of the supreme, the imperial demands of political expediency.

That Mr. Daniels has failed to rise to the magnificent opportunities of his position is rather his misfortune than his fault. Doubtless, he is as patriotic in the motives which are the mainspring of his administration as he knows how to be. If his usefulness has been curtailed and the interests of the Navy have suffered as the result of prejudices born of a somewhat circumscribed environment and a passionate belief in the supreme necessity imposed by party politics—the failure, so far as he is concerned, should call more for pity than censure.

But, alas and alack! This is not a question of the fortunes of one civilian member of the great republic, but of the very life and death of that republic itself; and if the efficiency of our first line of defense is being impaired by the inefficiency of the gentleman who, above all, is responsible for maintaining our naval defenses, there is a distinct call upon his self-sacrificial patriotism to bid him step down and make way for a better qualified successor.

The present Secretary is hampered by his political obsessions. He is more concerned as to whether the Wilson administration is building a greater number of ships than did the Taft administration, than he is with the question as to whether we are building enough ships to make the country safe. His many past statements bearing upon this question are of record.

The present Secretary is hampered by his grossly mistaken impression that there is a breach between the officers and men in the service—a lack of sympathy on the part of the man wearing the shoulder straps for the enlisted man. He has said so, not in so many words but by implication; as when he suggested that the officers should mess with the men; or as when, in the matter of abolishing intoxicants from the Navy, his voluminous press notices and public speeches were so unbelievably tactless as to cut to the quick the proper professional pride of our naval officers, and run the risk of conveying to the world at large the altogether false impression that hard drinking was prevalent in the mess rooms of our ships.

The present Secretary is hampered and the safety of the country is imperiled by his bitter prejudices on the subject of profits made by private manufacturers of ships, armor, guns and naval supplies. The attitude of a wise and far-seeing Secretary to the private manufacturing concerns of the country should be one of confidence and friendly coöperation. The Government is not in the position to supply itself, especially in the event of war, with a sufficiency of these products and, in the nature of things, never will be. Since it will always be largely dependent upon private enterprise, contracts for the Navy should be made attractive, and the Secretary should cultivate the closest relations with the gentlemen whose industry, ability and capital have built up our private yards and gunshops. But, as a matter of fact, the present Secretary has treated these gentlemen with a courtesy so scant that it comes very near to contumely. His rejection of bids which were made, we believe, in all good faith has resulted in delaying, for over fifteen months, the construction of two of our latest battleships—this at the very time when the country is imperiled by the relative weakness of its battleship fleet.

As revealed elsewhere in this issue, the great engineering societies are just now engaged in mobilizing the private concerns for the defense of the country—how shall this venture succeed if the spirit of Mr. Daniels is to pervade the policy and shape the legislation of Congress?

Trademark Legislation

FORTUNATELY for the business interests of the country, every innovation in the trademark law which is proposed by one or another of our transient legislators, in Congress assembled, does not become part of the law of the land. These bits of potential legislation drop out of a clear sky from any and every quarter. Some are elaborate schemes contemplating radical changes in policy. More of them are specific amendments relating to details, of hit or miss character, often ill-considered and calculated to do inestimable harm and little or no good.

Of the latter type appears to be a bill recently introduced in the Senate, to amend the trademark law, with the object of prohibiting the registration of a trademark which consists in the name of "any church, religious denomination or society," or "the name by which any church, religious denomination or society is *commonly known or called.*"

Pick up any magazine and turn to the advertising pages. One of the first things you are sure to see is an expensive advertisement of *Quaker* Oats. To be sure, the proposed amendment is not intended to be retro-active, and would not affect trademarks already registered; but suppose the manufacturers of this cereal were now just applying for registration, and the present Statutory Trademark Law had already been amended as proposed; imagine their loss owing to the refusal of the Patent Office to register their trademark, and their consequent inability to avail themselves of the protection afforded by the Federal Courts and the additional benefits conferred by the Statute; to all of which they are entitled owing to their first adoption and continued use of the trademark in their business.

Many of us use "*Shaker*" salt upon our tables daily, and know the article by no other name; nor do we know the name of the manufacturer. Yet this mark, also, comes within the prohibition of this law, which forbids the registration of any mark which consists of "the name by which any religious society is *commonly known.*"

Again, the effect of such a provision is not limited to articles made in this country. It applies equally well to goods imported from Europe. Perhaps no better established mark is known than that which, dating back several centuries, identifies the cordials distilled by the monks at La Grande "Chartreuse," prior to their expulsion from France to Spain. This "Chartreuse" mark was unanimously confirmed to the monks by the Circuit Court of Appeals in New York a few years ago. Yet under this proposed amendment to the trademark law no such business could again be gathered around the name of a religious organization or church with the sanction of the Federal laws of this country.

Here again are international complications; since such a mark may be perfectly good and valid under the laws of France or Spain, for instance, where the goods are made, and yet the mark of origin, well known abroad, could not be protected by registration in this country.

This is but a sample of many bits of legislation that are constantly being presented to Congress by our Federal law-makers. Most of them find their well-merited death at the hands of the "Committee on Patents," to which all legislation relating to Trademarks, Patents, Copyrights, etc., is referred. This committee has been, and should be, carefully chosen from among the level-headed, conservative Congressmen, who realize the extent to which the business of the country is built around and upon the good-will associated with established trademarks. It behooves the business men of the country to see to it that the wholesome check which this committee affords against hastily prepared and ill-considered legislation be vigorously maintained.

Pan-American Science

ECHOES of the Pan-American Scientific Congress, recently held in Washington, have not been heard so frequently as might have been expected. If the consensus of opinion in regard to the congress could be ascertained, it would probably be that the gathering was a success—with qualifications. The nature of these qualifications is, in part, represented by the heading of an article by Dr. William McClellan, vice-president of the American Institute of Electrical Engineers, recently published in the *New York Times.* The heading, which is worth quoting, runs thus: "Pan-American Congress a Success; Credit Due to Visitors Rather Than to Our Scientific Bodies; Pan-Americanism Still an Undefined Expression."

Without attempting to analyze the text of Dr. McClellan's interesting article, we venture to set down a few comments suggested by the phrases above quoted. The Pan-American Congress was a success, in the sense that it was fairly well attended, and that the participants derived both pleasure and intellectual profit from it. On the other hand, to any one imbued with a love of true internationalism in science, the geographical limits imposed upon the congress were so illogical as to dampen one's enthusiasm for it. There may be sound political and economic reasons for an international gathering confined to representatives of Latin-America and the United States, while excluding not only the Old World, but also Canada and the other European possessions in this hemisphere, but these have nothing to do with science. Again, it would seem natural for the Latin-American countries to hold Latin-American scientific congresses. Above all, it is urgently desirable that the Latin-American countries should be more generally represented than they have been in the past in scientific meetings of world-wide membership, and in world-wide scientific undertakings of all kinds. It is, however, anomalous and inexplicable that the scientific men of Latin-America should enter into any sort of union or alliance that includes the United States but does not include Europe. Geographical proximity does not explain such an alliance, because the facilities for travel between some countries of South America and Europe are actually better than they are between the same countries and the United States. Identity of political ideals does not explain it, because, in the first place, there are true democracies in Europe, and, in the second, some of the Latin-American countries are more oligarchic than democratic. The conditions arising from the European war do not explain it, because they are only temporary. The Pan-American Congresses are planned to be a permanent institution. The next one is to be held in Peru in 1921.

The criticism that the credit for the success of the recent congress is due to our Latin-American visitors rather than to our own scientific bodies is—in so far as it is well-founded—easily answered. The leading scientific bodies of the United States were not consulted when the congress was planned. If they had been, the extraordinary blunder of holding the congress in Washington coincidently with the meeting of the American Association for the Advancement of Science in Columbus would have been avoided. Moreover, many scientific men who attended the congress gained the impression that the meeting was primarily a political rather than a scientific one; and it is undoubtedly true that the political aspects of the congress overshadowed everything else. The keynote was struck at the opening session, when the speeches, nearly all delivered by politicians and diplomats, harped on "preparedness" and the Monroe Doctrine.

Finally, as to "Pan-Americanism" being an undefined expression, there are many people who believe that it is not so much an undefined expression as the expression of an incongruity, and especially so in its application to intellectual affairs. That cordial relations should be fostered between ourselves and our Latin-American neighbors everybody admits. That we should form a closer alliance with Latin-America than with Great Britain, France and Germany—or, not to particularize them, with the countries from which chiefly we derive our culture and our traditions—is a proposition from which many politicians and economists would strongly dissent, while to the average man of science it is simply preposterous.

Following the same line of thought, we feel that Dr. McClellan's criticism is beside the mark when he contrasts the facility of the Latin-American visitors in English with the inability of our compatriots to speak Spanish. Spanish-Americans have, in general, far more need of our language than we have of theirs. This is conspicuously true in science. The scientific men of Latin-America learn English for the same reason that our scientific men ought to—but too frequently do not—learn French and German; viz., in order to be able to read a large and important body of scientific literature, and to hold intercourse with their colleagues in the countries where science is mostly actively prosecuted.

The Army Bills in Congress

IT is appropriate at this time to review the results of the nation-wide demand for preparedness as reflected in the attitude of Congress. Three measures of great import have been published: Senate Bill 4840; House Bill 12766, and the bill for universal training. The first two, popularly known as the "Chamberlain Bill" and the "Hay Bill," respectively, command the immediate attention of the people. The effect of these measures upon the Regular Army is shown in the following table:

	Authorized at present	Chamberlain Bill	Hay Bill
Infantry, Regiments	31	65	41
Cavalry, Regiments	15	25	15
Field Artillery, Regiments ...	6	21	12
Engineers, Companies	12	48	27
Coast Artillery, Companies...	170	263	222
Totals, including auxiliary troops	87,240 to 120,000	178,000 to 248,000	155,000 to 172,000

The difference between the first and second line of totals is due to the system of maintaining skeleton organizations, the second line being the war strength to which the President is authorized to raise the units at his discretion. The Hay Bill provides that the total increase shall be made in four equal yearly increments; the Chamberlain Bill extends the increase over five years. Although the Hay Bill contains some sops in the way of providing for training camps and rifle practice, it is so defective in its proposed organization of the Regular Army that it may be dismissed as a measure too amateurish in conception to merit the consideration of thoughtful men.

Except for the skeleton organization, which our ablest officers condemn and have strongly opposed, the Chamberlain Bill, in so far as it affects the Regular Army, is worthy of earnest support. It provides troops properly organized for seven tactical divisions (troops of all arms in proportions best suited for war, aggregating each about 17,000 peace strength and about 24,000 war strength), for two cavalry divisions (troops of all arms except infantry, all mounted and aggregating about 14,000 peace strength and about 20,000 war strength) for coast artillery companies to garrison our foreign forts and to man one half the seacoast guns at home, and for the necessary staff corps. This would permit the stationing of one tactical division in the Philippines, one in Hawaii and one in Panama, leaving four tactical divisions and two cavalry divisions in the states. The excess (two infantry regiments) over the seven tactical divisions are for service in Alaska and Porto Rico.

That Senator Chamberlain realized the weak point in his bill is evidenced by the change proposed in the enlistment contract. He proposes that a soldier, who by diligence and aptitude shows his fitness, may be furloughed to the reserve after one year with the colors instead of four, thus offering an inducement to enlist for a short term to young men who do not look with favor on four years in the ranks, and also hastening the formation of reserves to fill up the regiments in case of war.

And the need for some action is urgent. The reserve clause of the present law is just beginning to be effective; but at the best, under existing conditions, we can hope for only 10,000 men to pass to the reserve each year. At that rate it would require seven years to fill up the skeleton companies, troops and batteries. But with the changed enlistment law we may feel certain that, at the end of the five years required for the increase, there will be reservists enough to enable our regulars to take the field at full war strength—a quarter of a million trained soldiers. It may be asked what we shall do if attacked in the meantime. This has been covered by authorizing the President to make the entire increase at any time war is imminent.

The Chamberlain Bill then proceeds to authorize the President to organize and train, at any time, a volunteer force of about 270,000 troops. These are to be United States Volunteers, entirely separated from state control, and governed by the same rules as the volunteers of 1899, who gave so excellent an account of themselves in the Philippines. In other words, a truly federal citizen soldiery. The state troops are authorized to join this new force, and this, the General Staff believes, is the only plan, not involving an amendment of our Constitution, which will accomplish the much desired federalization of the militia.

Had Senator Chamberlain stopped there, he would have been deserving of unqualified praise and gratitude. He would have presented the first thoroughly thought-out military legislation ever laid before Congress. Had he included in the bill a provision for the universal training of our boys, he would have fulfilled the cherished desire of our military experts and of an ever-increasing number of our leading citizens.

Unfortunately, he has put in his bill, as a "rider," a militia project which contradicts the principles of the volunteer clause above referred to and which cannot be too strongly condemned. Considering the able legislation marking the first part of his bill, this appears to be one of those unhappy compromises which sometimes mar congressional action. The portions of the Hay and Chamberlain Bills relating especially to the militia, while differing in detail, are so nearly identical in effect as to indicate the same guiding hand. We have all heard of the militia lobby in Washington, and we are forced to the conclusion that it has succeeded, through political pressure, in having adopted a plan not desired by the best and, it is believed, not by the majority, of our militiamen.

While the last part of both these bills purports to give the central government greater power to control the troops maintained in the states, in fact they can do no such thing. Impressed, apparently, by an opinion of the Supreme Court, dissented from by our ablest constitutional lawyer, Justice Story, in a case where the powers of the general government over militiamen who refused to obey a constitutional call of the President was being determined, the framers of this bill have assumed that the decision of the Supreme Court as to the general powers of the federal government might be extended to cover the following, and the bill so provides:

That only certain classes shall be eligible to appointment as officers of the National Guard;

That its officers shall be appointed by the President;

That the general government shall prescribe the number of drills;

That the general government can require the National Guard to participate in maneuvers;

That the President may prescribe the special units to be maintained in each state, and may require a reserve for each;

That, when Congress has authorized the use of the land forces, the National Guard may be required to perform any service within or without the continental limits of the United States.

All of the above are desirable, and are necessary to complete federalization; but the bill expressly states that the National Guard shall be a division of the militia, and consequently leaves it subject to the political evils of state control. For the Constitution has expressly reserved to the states themselves the right "to appoint militia officers," to "train the militia," and "to govern the militia when not in the service of the United States." The Constitution also definitely prescribes when the general government may call the militia into its service, limiting it to "repelling invasion," "suppressing insurrection," and "enforcing the law."

Plainly the bill is not constitutional; the first contest cannot fail to show that. The danger in the present situation is that the states will acquiesce in the abridgement of their rights: first, because the federalization of the militia is recognized as being a desirable thing; and, second, because it is proposed to pay the militiamen from federal funds. In this way there will become fastened upon us a system which will endure only so long as those affected desire it to continue. Our military strength would be founded on shifting sands. Nay—worse than this. State politics have always governed the militia; this bill proposes that state politics shall control our national defenses. The influence of state organizations, semi-military and semi-political, maintained and encouraged by federal funds, will soon become too great to control, and with increased strength will come increased demands, both for preferment and money. It is idle to say that the militia has changed. As long as the states control, and under our Constitution they must control, the militia, there will be the same inherent defects. The pressure of state influence necessitated the replacement in 1899 of the state volunteers by federal volunteers over whom the central government had full power. *An army can be efficient only when there is one commander-in-chief.*

It is to be hoped that Congress will neither be deceived nor browbeaten into making this grave mistake when the way is so clearly before it. There are few Americans to-day so blind as not to realize that, for national security, we need five things, all of which must be considered together:

First: A strong, well balanced and fully manned Navy;

Second: A standing Army of sufficient strength and so organized as to furnish a reasonable garrison for each of our vulnerable outlying possessions, and to leave at home a force which, in connection with our Navy, will hold an enemy from our vitals for a period sufficient to permit the mobilization of our citizen forces (the Chamberlain Bill provides this);

Third: A federal citizen army, organized and so trained that three months' maneuvers will fit them for war service (the volunteer clause of the Chamberlain Bill provides this);

Fourth: A system of universal training of our youth, to cease at the age when they enter business or professional life, the training to fit them to give effective service to the nation if it be attacked (the Chamberlain Bill for universal training of the citizen forces provides this);

Fifth: The organization of our great resources so that they could be utilized in war under control and without waste.

We wish for peace, but peace, like all other desirable things, is to be obtained and assured only by wisdom, effort, and sacrifice. The organization proposed for the defense of this country in the above program would probably prevent any nation from seriously considering an attack upon us, and should we be attacked, it would serve to limit initial disaster and give assurance of ultimate victory. Incidentally, it would cost no more, and probably ultimately less, than the political Frankenstein of confusion and inefficiency which threatens this nation in the militia sections of the bills now before our Congress.

New Industry Formed Through Supply of South African Talc

TALC or soapstone is now being shipped regularly to Great Britain from South Africa, a development in the industry which has taken place since the beginning of the European war. The South African talc is being supplied from the Barberton district, but it is also found in Rhodesia. The *British and South African Export Gazette* states that its discovery is almost a romance, and pays a tribute to the patience and perseverance of the man who was solely responsible for it.

For over six years, states the journal previously mentioned, the man continued his prospecting work, often in the face of ridicule, and more frequently of calumny. Thus the early history of the Rand repeats itself. Today the man who has developed this industry bids fair rapidly to become a millionaire, for French chalk is a commodity that is used in enormous quantities in a multitude of diverse industries, and the only limitation to the demand for the South African product will be the difficulty of securing the tonnage. South Africa and the motherland will be the richer for what, but for the times, would rightly be regarded as a sensational discovery of unusual magnitude.

The United States, however, is not only the largest producer but also the largest consumer of talc and soapstone in the world; and although producing much more talc than all of the other nations combined, this country imports some of the finer grades from France and Italy. The quantity produced in the United States in 1913, as reported by the United States Geological Survey, was 149,271 short tons, valued at $1,280,020.

New York is the leading producer, with an output for 1913 of more than 54 per cent of the total production of the United States, and far outranking all other states except Vermont, which has in recent years greatly increased, having a production in 1912 and 1913 of more than half that of New York. Of the total output in 1913, by far the greater portion, 147,529 short tons, was sold as ground talc; 238 tons as pencils or blanks for making gas tips, etc.; and 1,504 tons was sold rough as it came from the mine.

Method Determining Oil and Resin in Varnish

RESULTS of experiments to find the best method of determining the oil and resin in varnish have been published by the United States Bureau of Standards in Technologic Paper No. 65. Several methods are discussed, but the conclusion reached by the Bureau is as follows:

The proposed method for the determination of oil and resin, involving esterification by the Twitchell or Wolff methods, the use of ether as solvent after esterification and correction of the figures by appropriate factors, gave results which were sufficiently accurate for practical purposes, and appear to be the best method so far devised for general use.

In explaining the situation that led to these experiments, the technologic paper states that in spite of the fact that several methods have been published for the determination of oil and resin in varnish, there has been a noticeable lack of information regarding the accuracy of the results obtained, due largely to the failure to test the procedures with varnishes of known composition and history. It was considered desirable, therefore, to obtain such information and to devise, if possible, a method which would be satisfactory. It is shown by the Bureau that several methods to be found in the literature are not reliable for all types of oil varnish.

A Successful Experiment in Skunk Farming

How Two Brothers Found Skunk Farming a Profitable Business Enterprise

By H. D. Jones

WITH an acre of ground and an outlay of about a hundred dollars, two brothers of Trumbauersville, Pa., have made a marked success of an experiment in skunk farming. Last Fall they sold no less than 700 skunks for breeding purposes, to buyers in the West, in Canada and in Europe. The prices realized averaged eleven dollars for males or females of the first grade and eight dollars for second grade animals. The latter were sold mostly for domestic purposes, the skunk being the finest mouser in the world and an affectionate pet when deprived of his objectionable means of offense.

The story of the successful experiment with skunk raising as a business is told by the brothers in a most interesting way. They had always, from boyhood, been fond of trapping in the wild country around their native village, and few holes and corners of the woods in that part of Bucks County were safe from the trappers and their dogs. At that time they trapped everything trappable, chiefly 'possums, 'coons, minks and musk rats. But the business was a poor one, for all the farmers of the vicinity hunted the little animals to death and when 'coons were placed under the protection of the law and the field became still more limited, it scarcely paid to stay out all night after the little fur bearing animals for the sake of the small amount paid for the pelts.

But one day inspiration came to the trappers through the capture of an unusual bag of skunks. The brothers carried home no less than seven of this fur bearing animal. All were females, and this gave them their big idea. They decided to cage the seven skunks and hope for interesting developments in the future. Their hopes were abundantly realized, for every one of the seven captured skunks turned out to be a prize. The first to prove the good fortune of the trappers presented them with seven little skunks at a litter and the other six came nobly to the mark until the seven skunks trapped in the winter had increased by the spring to thirty-seven.

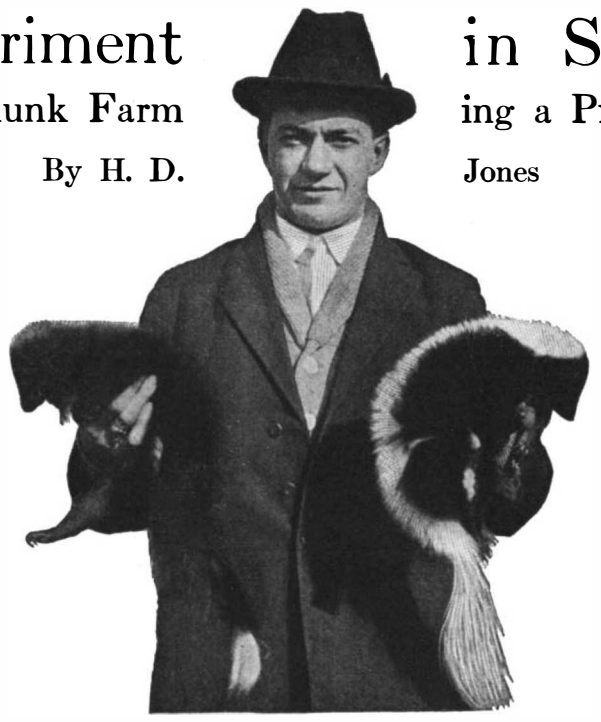
With this substantial colony as a beginning the brothers started their farm. They now keep about 200 skunks in the pens, adding to the captive breeders from time to time by excursions to the neighboring woods for fresh stock.

The pens were easily made. The brothers bought six bales of inch mesh wire at $15 a bale, boarded the floors and made the pens water proof by tar roofs. Thus were the skunks provided for for all kinds of weather.

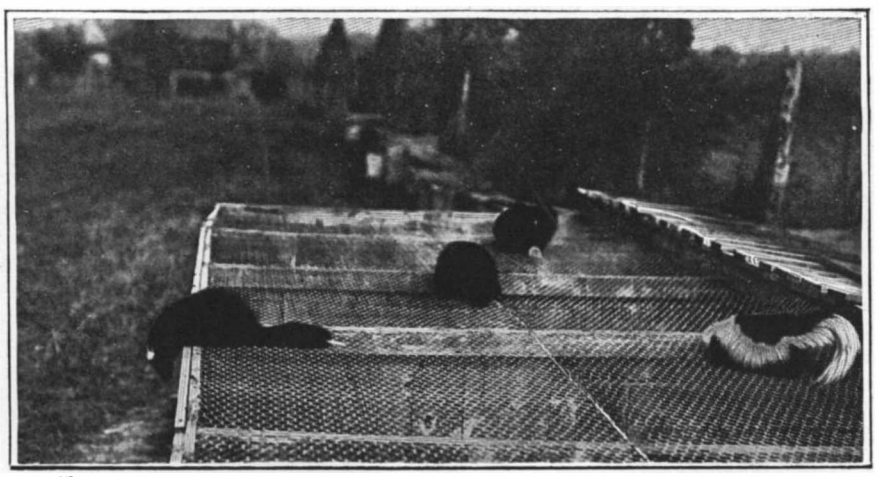
In the early days they lost a few of the animals from illness due to ignorance of the proper kind of feed for them, but more from boys of the neighborhood who raided the pens at night until the skunk breeders caught on to the fact that the animals were not digging their way to freedom in some mysterious manner, as was thought, but were being assisted out of captivity by two-legged depredators. Since this truth dawned upon the brothers and they were able to take proper precautions to guard against it there has been very little loss.

Care had to be taken to keep the animals properly fed, for if hungry they would not hesitate to attack each other. If left for a long time without food it would be a case of the survival of the fittest in the pens, for the skunks are cannibals of the worst kind and do not hesitate to kill and eat their own immediate relatives if driven to it by hunger.

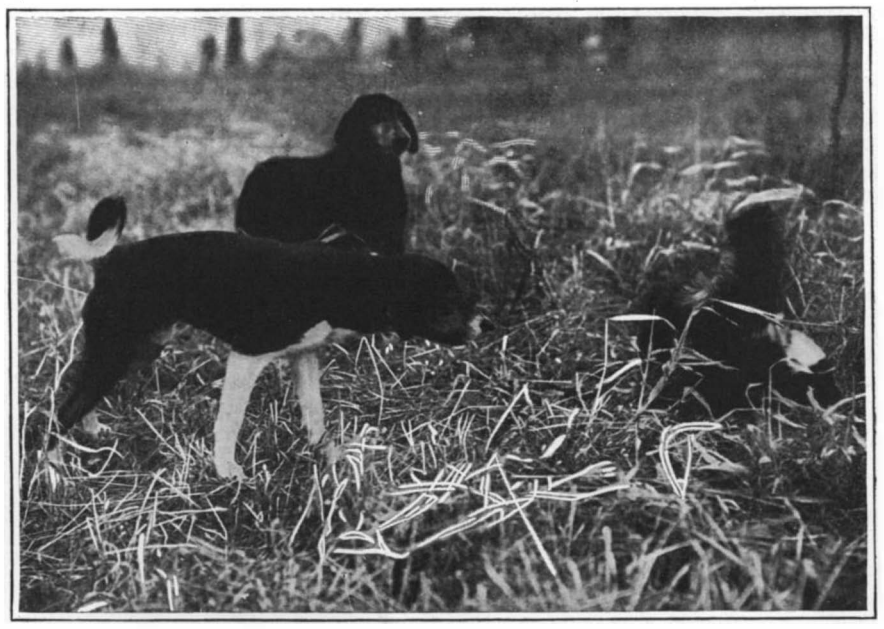
Occasionally the skunk breeders found they had trapped a Tartar in the shape of a fierce and vindictive male who would live at peace with no one. There was never any choice but to get rid of one of these fighters for every skunk in the same pen would be chewed up in the struggle that followed his introduction to what had previously been a peaceful and contented family. As wounds on the animal spoil the fur, which is too small to permit of much scarring of this sort, it was found wise to watch newcomers carefully when a skunk fresh from the wilds was introduced to the colony. If he showed fight at the start he was promptly banished to the woods from whence he came, or his pelt left hanging in the drying shed.



A pair of skunks. The one at the left is almost all black

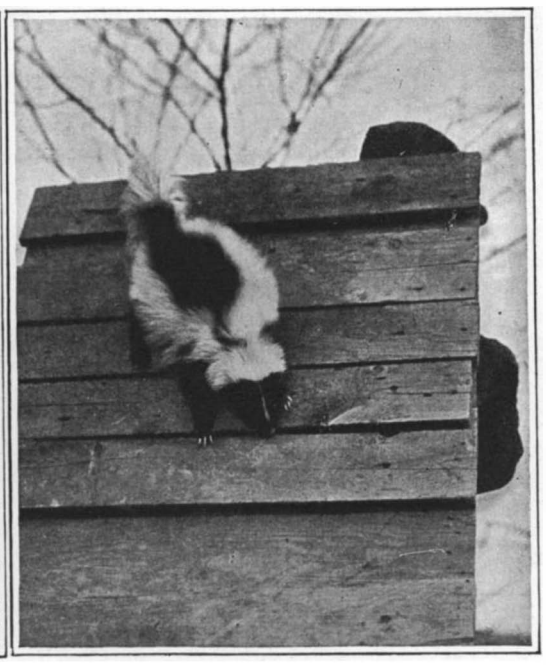


Skunks on top of their cages with nothing to prevent them from escaping



The trained dogs employed by the skunk farmer in hunting and capturing skunks

Method of holding skunks—by their tails



A black-and-white marked skunk, showing the beauty of the fur

Early in the three years' experiment that the brothers have been conducting it was found that the profits of skunk farming lay not so much in the sale of the pelts as in the sale of the animals themselves for breeding purposes. The increasing demand for skunk skin for purposes of feminine adornment and protection induced many persons throughout the country to start skunk farms, and the establishment of these farms made it possible for the breeders to derive a brisk trade in the animals themselves. As the skins had not been selling for very high prices, this departure in the business was the beginning of a satisfactory return for the breeders.

The skins that are most valuable for marketable purposes are those that are free from white marks. The brothers found the scarcity of black furred skunks one of the most formidable obstacles in their way when they first started the breeding business. The animals trapped were for the most part strongly marked with white and these were so unpopular with the pelt dealers that it was not possible to get more than 25 cents for the very heavily marked, while $2.25 was the highest price paid for skins that showed but a little trace of the white marking.

So the brothers set to work to eliminate this particular obstacle by careful breeding. Selecting the nearest to all black animals they could procure by trapping, or which came into their possession by the births in the captive colony, they bred these; and in time they have succeeded in obtaining an animal that is almost all black—the only white markings are on the tips of the ears, these being so obscure that the skins would almost sell for totally black. But the skunk breeders are not yet satisfied: they are determined to procure an animal that has not the slightest trace of white in its fur. So confident are they of their ability to do this that they declare it will be an accomplished fact in a very few months.

Meanwhile they have found a market for the marked skunks by creating a demand for them as pets. For this purpose they are preferable to the all black skunks, for, as can be gathered from the accompanying illustrations, the white and black animals are very prettily marked. When there is added to their pretty appearance the affectionate disposition of the animal when it comes to know its owner, and the fact that it is death to all kinds of household pests, its value in domesticity can be estimated. For the white and black skunks sold separately as household pets the two skunk farmers have been getting eight dollars each. This is a sort of side line with them for the farmers and boys in the vicinity trap the skunks and sell them to the brothers for five dollars each. After a little simple operation for the removal of the scent sacs the brothers can then sell them at a handsome profit. There is a steady demand for these "safe" skunks, both from city dwellers and from farmers and others who want them around the house and the barns to keep vermin away.

According to the breeders, there is little fear that a skunk kept around a farm will kill the chickens. It certainly will if it is not fed properly, but according to these experts the skunk that is fed regularly by its owner will not trouble the poultry; rather it will keep to the house and only roam around at night in search of rats, mice and insects.

The brothers estimate the cost of keeping a colony of 50 skunks for a year to be about $100. The food they eat and thrive on is largely the remains of the family meals, meat and vegetables. A scientific investigation of the stomachs of

(*Concluded on page* 366)

A Cinematograph Screen That Does Not Need Darkness

ACCORDING to the latest statistics, nearly 16,000,000 people frequent daily the "movie" shows here in the United States. And there are fully 18,000 of these showplaces in operation. Darkness is essential to successful display, and this needful gloom has been abused more or less seriously. To avoid these consequences the laws of some states require that the picture theaters be illumined every 15 minutes during the show. The reels are highly inflammable, and panics occasioned by their conflagration have more than once caused grave loss of life.

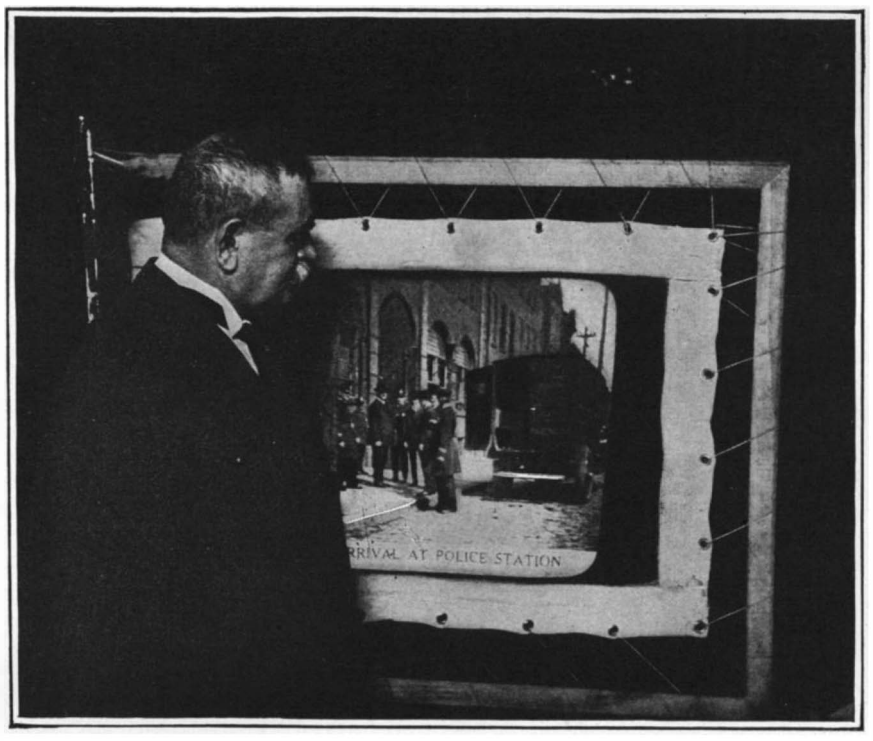
But now, thanks to the successful development of a satisfactory translucent screen, it is not only possible to greatly lessen the hazards incident to a darkened showplace of this sort, but daylight movies are practicable. In other words, with the screen invented and developed by John F. R. Troeger, pictures can be projected without the usual enveloping gloom. The hall can be fully illuminated. Instead of placing the projecting lantern in the theater and among the spectators, the translucent screen makes it feasible to locate this apparatus back of the theater and in a fireproof room—a single opening in the intervening wall sufficing for the projecting rays to reach the screen in front of it. Should anything go wrong with the lantern, there would be nothing to alarm the audience.

This fireproof screen, because the light rays pass on directly to the spectators, and because of the nearness of the projector to the screen, permits of a very high illumination of the image, contrary to the usual white screen and the more remote lantern. Further, because the surrounding atmosphere is lighted up the eyes are not taxed by the contrast between the ordinary darkened hall and the more or less dazzling white screen. Besides this, the spectator gets a more realistic picture and one with but little distortion, no matter where he may sit in the house. This is due to the texture of the surface of the Troeger screen.

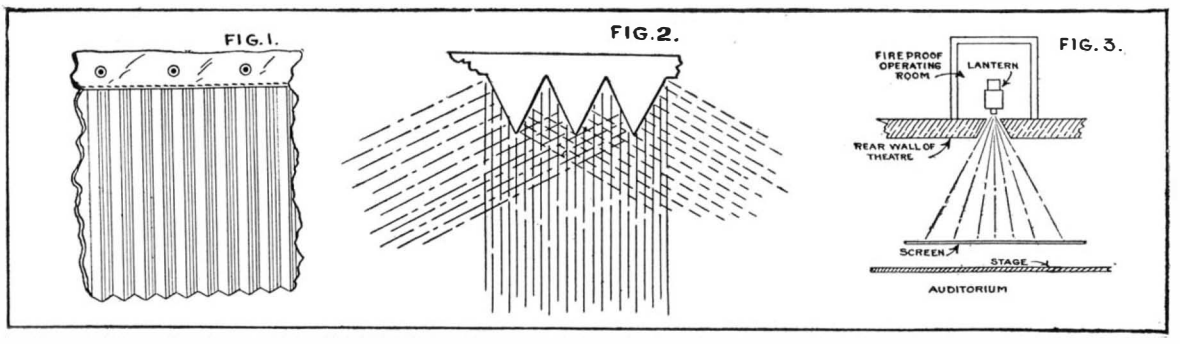
The front of this screen is marked vertically by very fine ribs or prisms, and these serve to show the picture with but little lateral foreshortening, even when the point of view is well off to right or left. The pictures, besides, are truer to Nature than the photographs on the films. That is to say, they have more depth and are not marked by that "flatness" so common to most motion picture displays.

The camera is a one-eyed instrument, and two eyes are necessary to get the double image which produces the sense of depth. The projecting apparatus ordinarily simply reproduces the flat photograph. But the ribs on the Troeger screen give our two eyes the duplex images we are accustomed to, and thus we get the so-called stereoscopic effect which nature intends we shall have when viewing any object that has form and not flatness.

For educational purposes a translucent screen of this character is much to be desired, because it permits the lecturer to see his audience and thus to promote sympathy. At the same time, the spectator's attention is apt to be far more constant, and there is less likelihood of the eyes being tired or of a hypnotic effect induced by glare.



A model of the new motion picture screen in which the projector is placed in the rear

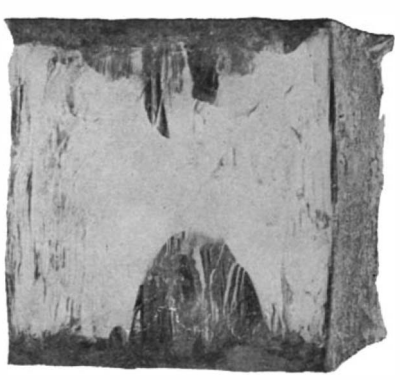


Features and principles involved in the new motion picture screen

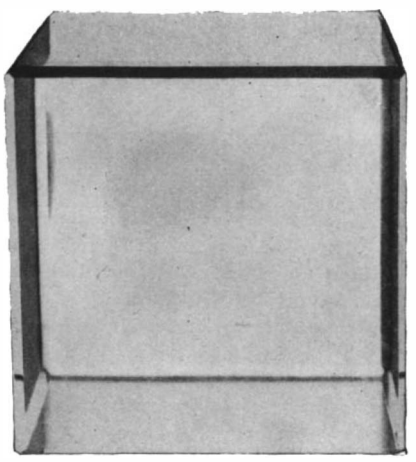
Fig. 1.—Corrugated surface of the screen. Fig. 2.—Illustrating the broad principle upon which the ribs or prisms cast the picture rays directly ahead and on both sides. Fig. 3.—General plan of a thoroughly safe motion picture installation made possible by the translucent screen

Exposition of Artificial Limbs and Equipment for Manufacturing Them

THE Russian Embassy at Washington announces that a prosthesis exposition is being held at Petrograd this month. In connection with the exposition there will be a competition of inventions and appliances in the making of artificial limbs. The prizes will consist of money awards and will be of different classes. Space will be given free of charge at the exposition and exhibits will be allowed to enter Russia free of duty.

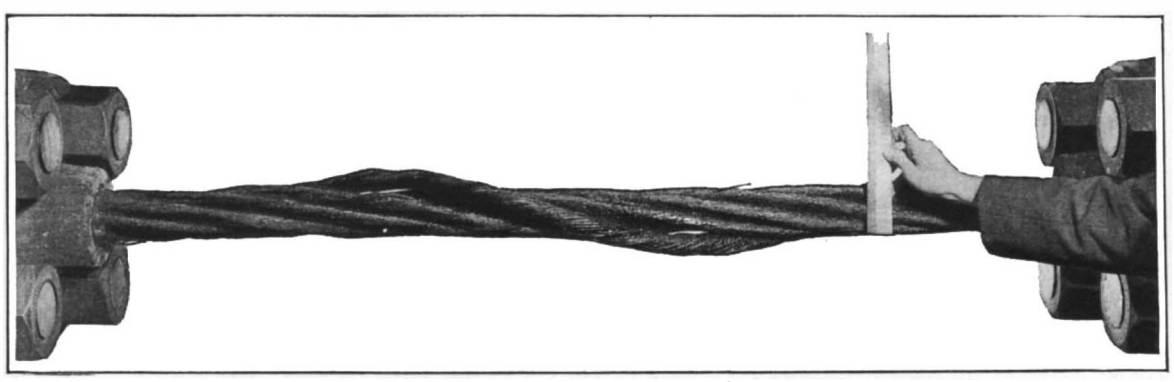


View of the glass cube after being subjected to a pressure of 2,600,000 pounds



Glass cube before being subjected to pressure test. It measures ten inches square

Another view of the glass cube after the pressure test, showing the shattering effect



Steel cable measuring 3¼ inches in diameter, after being subjected to a load of 937,000 pounds

Testing the Tensile Strength of Different Materials

THE accompanying illustrations are of particular interest in that they clearly show how a glass cube is shattered when subjected to excessive pressure and also the effects of an excessive load on a steel cable.

The three illustrations of the glass cube show the article before and after the test. The cube measured 10 inches on all sides and withstood a pressure of 2,600,000 pounds or 26,000 pounds per square inch. The cube as it appeared after the test is shown in two views, one of which shows the remarkable shattering effect of the pressure. Cubes of this kind are used as insulators for masts of wireless stations and must support several tons' weight.

The remaining illustration represents a 3¼-inch steel cable, one strand of which failed when a load of 937,000 pounds was applied to the cable.

The tests were made on the large Emery testing machine at the Bureau of Standards, Washington, D. C.

The Current Supplement

THE same conditions that are bringing industrial prosperity to this country are also tending to increase prices—not that the reasons are applicable in the case of most food supplies, but because the wily merchant seizes upon the increased prices of war materials as a pretext for boosting the price on everything else. Such being the conditions, however, the article on *Food Selection*, for rational and economic living, in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2100, for April 1st, 1916, will be of universal interest. *High Explosive Shells* is another article that is timely, for it describes and illustrates the construction of the various kinds of ammunition that is being used by the Allies in the terrific artillery duels that are so constantly being fought in Europe. *Photochemistry* deals with researches in relation to the chemical reactions caused by the action of light. This issue contains another of the series of articles on *Some Noted Zoological Parks*, the subject of this instalment being a description, with numerous illustrations, of the National Zoological Park, at Washington. The valuable paper on *Light and Illumination* is concluded. *Finding Your Way at Night Without a Compass* will appeal to every soldier, explorer and traveler in unsettled regions, and also to many others. It is illustrated by a number of diagrams. *Flame Standards in Photometry* deals with the necessity for a reliable basis for measurements of light, the conditions to be met and facts relating to the lamps used in an extended investigation. Other articles of interest in this issue include *Jupiter — The Solar King*, *Sources and Collection of Rubber*, *Turbine Blading* and a discussion of *The Phenomena of a Moving Automobile Wheel*.

"Rondonia"

IT is proposed to give this name to the region of Brazil lying between the Juruena and Madeira rivers in honor of Col. Rondon, who was associated with Mr. Roosevelt in his famous journey down the "River of Doubt," and has done so much other admirable work in exploring and building a telegraph line through the Brazilian wilderness. The new name for the region is a most acceptable one.

Naval Consulting Board's Committee on Industrial Preparedness—I

The Comprehensive Plan for Mobilizing the Nation's Industries for War

A RECENT talk by a member of our staff with Mr. Howard E. Coffin, Chairman of the Committee on Industrial Preparedness of the Naval Consulting Board, enables us to present the following summary of the plan and scope of the work of this committee.

It was realized at the very outset that the problem of naval and military preparedness resolved itself into the military and the industrial sides, and that as the military side was very efficiently taken care of by the men at the heads of the departments of the Army and Navy, so the industrial side, when it came to the question of the mobilization of the industrial strength of the country, was that with which the members of Mr. Coffin's Committee on Industrial Preparedness was immediately concerned and for which it was specially qualified. In the opinion of the chairman, the course of the European War during the past twenty months has entirely upset our preconceived notions of warfare, and the problem has very largely settled down to a question as to which of two combatant nations can fastest and for the greatest length of time feed the necessary supply of munitions to the men on the fighting line. Side by side with the mobilization of the professional fighting men we have seen the mobilization of the men, women and children of the nation in the production of some one or other of the multitudinous supplies which must flow without let or hindrance to the armies at the front. The question of ultimate military success is one not merely of the ability of the professional fighting men of the Army and Navy, but of the ability of the industrial brains and the skilled hands of the whole citizenry of the country. If the nation is thus to back up the Army, the work must be largely done in the time of peace—we cannot wait until the thunderbolt of war strikes.

The work of the committee has naturally resolved itself into three stages. The first is to determine exactly what the country can accomplish in making munitions; the second is so to apply that knowledge that the whole of the manufacturing plants can be put at the service of the Government; and the third is so to organize skilled labor that such of it as is required will be retained in the various industries and not rushed away to the front, as happened so disastrously in the allied countries during the early months of the war. "From the way things have been shaping themselves during this war," said Mr. Coffin, "it looks as though the skilled mechanic of the future will win the wars of his country, and that the banker, if you like, and the lawyer will be merely the men who will carry the gun to the front, there to serve the useful purpose of cannon fodder."

In laying out its plan of campaign the Committee on Industrial Preparedness realized that the work of tabulation and administration would have to be in the hands of the engineers of the country. In answer to a letter of President Wilson to the presidents of the leading technical organizations of this country, namely, the mining, civil, mechanical, electrical and chemical engineers' societies, a member of each society in every state in the Union was formed into a board of directors, which provided a board of directors of five men in each state. Serving under them are thirty thousand of the skilled engineers of this country. The first work to be done by these engineers will be to collect complete data as to the industries of the country. This will be done by means of printed forms, in accordance with the procedure and practice of the United States Census Office. The census will affect from thirty to thirty-five thousand concerns, and it will secure from them a business inventory of the character which any business man would require regarding any concern with which he is going to enter into business relations. Each form will have filled in the name of some concern regarding which information is sought, and it will be passed on by the state directors to the field engineer who is assigned to gather data regarding that particular plant.

Very considerable impetus will be given to this movement by the hearty coöperation of the National Chamber of Commerce, which has addressed a referendum to the chambers of commerce throughout the United States, which includes resolutions that coincide very closely with the program of the Committee on Industrial Preparedness. When the inventory, which will be made probably during the month of May, is complete, the next task will be to get the industries which have been enumerated into such shape that they can efficiently do the work required. Mr. Coffin states that there is not a manufacturer in this country who can start on quantity production of shells within one year after the receipt of an order, unless he has previously done shell work in his plant—in other words, the manufacturers have to be educated in the production of munitions, and this in times of peace. War-time demands are such that it will be impossible to provide sufficient government-owned plants to meet them. A certain number of Government plants we must have, and they should be scattered through the country. They should act as educational centers and clearing houses for specifications and blue prints; but in any future war of magnitude it is upon privately owned plants that we should have to depend. It would be a positive calamity if legislation in Congress this year should merely create a larger Army and Navy and a few munition plants, and then settle down under the conviction that the country is prepared.

As at present determined, it is proposed to give small annual orders for munitions to each of the selected plants, said munitions to be made according to Government specifications at such time in the year as may be convenient. Everything connected with this order will be done exactly as it would be were the order a war order of one hundred times the magnitude. The work will be educational. The purchasing department of the company will learn where to buy materials; the manufacturing department how to handle them, and make the necessary jigs and tools, equipment, etc.; the inspection department will become familiar with governmental inspection; the engineering department will become familiar with Government blue prints and specifications; the firm will become familiar with governmental methods of business, and the shipping department will know how to crate and ship the finished article.

An important phase of the work of the committee is the labor question, as affected by the proposed organization, which will insure against shutting down of plants, and will guarantee employment to the maximum number of men even when war is being waged. The ground will be cut from under the people who are forever finding out that there is a munition lobby at Washington; for it is proposed that the Government shall place orders upon some such basis as that of cost of production plus a reasonable and agreed-upon profit; and with this understood and with the further understanding by the mechanic that he is defending his country just as surely and honorably when he tends a lathe, swings a sledge or pours the hot metal into the mold, as if he were behind a machine gun or rifle in the trenches, the skilled labor of the country will rally to the cause of National Preparedness.

The question of the quantity manufacture of war supplies is an intricate and complicated one, and full of surprises. Absolutely fundamental to such work is the provision of an enormous number of measuring tools and gages—a very special line of manufacture in which only three concerns are actively engaged at the present time, namely, the Pratt & Whitney, the Brown & Sharp, and the Greenfield concern. These three have found in comparing estimates that to produce two hundred thousand shells per day, which is the amount under contract for the Allies at the present time, would require in gages and measuring tools alone an investment of from seventeen to twenty million dollars. The delay in the delivery of American-made ammunition to the Allies has been due largely to the lack of these gages. It is impossible to state the average time consumed by American concerns in producing the machinery and tools necessary to commence production on foreign orders, but many of the best known factories in the United States have been at work a year on the problem without producing sufficient finished product to be worth inspection. So much specialized knowledge and skill is necessary in producing war supplies, and particularly munitions of war, that it may be said to be a new art, and before the vast facilities of the United States can begin to wrestle with the problem of taking up this new art on an extended scale, it is necessary to start at once and well in advance of any possible conflict, a thorough and widespread system of education.

As showing the extremely special character of the work which is called for in producing implements of war, Mr. Coffin instanced certain testimony given before a special board in Washington, during which, in speaking of the modern military rifle, the expert witness stated that in the manufacture of the new model Springfield rifle, the receiver alone, which contains the bolt and firing mechanism, requires 120 separate and distinct operations before it is finished, which means that 120 gages must be prepared before this part of the rifle can be made. Furthermore, these gages, because of the wear due to abrasion, can be used only for from 8,000 to 10,000 gagings—they must then be scrapped.

Mr. Coffin is of the opinion that as the result of the placing of orders for munitions for our Army and Navy among the large number of firms that will be selected throughout the country, there will be a valuable return to the Government in the way of useful suggestions by the engineers of the various works for the simplification and improvement of the plans and specifications.

The Magnetic Hand

NEXT to the irreparable loss of an eye, doubtless the loss of a hand is the most serious affliction that can befall a man, particularly if the person thus mutilated be dependent upon some handicraft for his livelihood. The artificial limb makers have done much to restore symmetry of appearance in such cases, and even to enable the victim to perform the ordinary activities incident to daily life and certain forms of work by means of suitable prosthetic apparatus. But it has remained for the electro-technical engineer to provide him with a substitute which is not only capable of grasping and holding, primary functions of the hand, but supplies a strength equal to or in excess of that which inhered in the missing member.

At a recent meeting of a committee of the Union of German Electrotechnicians, Dr. G. Klingenberg urged that the Union endeavor to extend the use of electromagnetic apparatus for crippled workingmen, particularly those in all the iron trades, and in a late number of the *Zeitschrift des Vereines des Deutscher Ingenieure* he describes such a device. The sheath which holds the arm-stump is attached to an electromagnet instead of to an ordinary artificial hand or to a prosthetic tool-holder. This magnet is bell-shaped and mounted on ball-bearings (kugelig gelagert) so that its grasping surface is adjustable to any position desired. It is capable of being fixed firmly or may remain movable with a slight degree of resistance. Thus it obviously simulates the flexibility of the human wrist. It is connected with the necessary source of current by means of contact plugs (Steckers), and is thrown into the circuit by a motion of the sound arm, of the foot, of the chin, of the whole body, or of the stump of the injured limb itself. It is then capable of grasping, lifting, and moving any article made of iron or having an iron plate suitably attached. And since the coupling is flexible, the workman is capable of handling a great variety of tools, which as a rule do not even require to be specially modified, since the magnetic hand is capable of grasping the instrument in any required position. If, for example, a file is to be used it is placed near the point of the latter and clings there as soon as the current is on. Carpenters' tools, such as a plane, are provided with a suitable iron plate to provide a grasping surface. A stamper at a stamping machine (Stanzer) can handle his work even better than with the natural hand, since the sheet to be stamped can be grasped by the smooth upper surface. The strength of attachment may be graduated to almost any desired degree by using magnets of different sizes. Various modifications permit special forms of grasp as required, *e. g.*, by pincers or tongs (Zange). It is even possible by a combination of magnets to produce the action of the elbow joint, of the thumb, and of the four fingers of an artificial hand.

While this instrument is chiefly intended for use in large plants where it is easy to obtain the necessary current, sufficient power for the ordinary movements of the limbs can readily be secured by means of a portable battery. Dr. Klingenberg urges artificial limb makers to avail themselves of electromagnetic power by this and other devices, and also emphasizes the importance of action to prevent individual patents from monopolizing such devices to the disadvantage of the public welfare.

Discovery of New Asbestos in the Transvaal

THE recent discovery of fibrous asbestos occurring in South African rock formations in which asbestos has not heretofore been found, is reported by the American Consul stationed at Johannesburg. It is of a new and superior character, and one which, it is thought, may have an important bearing on the asbestos industry. It is said that the available quantity is considerable; that it is of a new color, mostly golden brown; of a greater length than any mineral fibre previously known, and of good weaving strength.

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.]

South American Trade

To the Editor of the SCIENTIFIC AMERICAN:

A great deal has been said and written about capturing the South American trade from the Europeans, but how much has actually been done, will be seen in a very short time after the war is over. We have had 18 months with a clear field, but later we will be up against every kind of obstacle both as regards trading and shipping. The Germans, British, French and Italians know the South American trade from A to Z, and having established the strongest banks all over the republics, and having the assistance of subsidized ships, they will be in a position to return with fresh vigor and fight to the last ditch in the way of undercutting prices of goods and steamer rates. The most important link in the chain is undoubtedly the strong banks already established there. London, Berlin, Paris and Rome have old established branches which cover practically the whole of Brazil, Argentina and Chile, and after many years of trading they know almost to a dollar how much credit to allow every customer. Is it likely that onr newly formed banks can find out a firm's credit from the foreign banking houses? Not much. This knowledge can very often only be gained by dear experience and lessons. Also, these banks have become accustomed to give their customers very long credits which is a thing we have in the past flatly refused to do. With us it has been a case of, Here are the goods, where is the money? It must also be remembered that the largest South American republics have been very heavy borrowers from England, Germany and France for many years and their governments have many loans still to pay off; also most of these countries have a fluctuating exchange which make it very necessary for an importer and exporter to study every detail of the countries' politics, crops and financial ups and downs in order to carry on his business without severe losses. Nearly all the big European banks and trading houses have their clerks in specially healthy localities and have excellent quarters for them and in this way the clerks are all together and can assist one another both in the office and in their recreations. The majority of the European firms are old established or new firms that have bought out old ones. These companies know all the little fancies of different customers; their native and home clerks have in many cases been with them for years and it is one of the surprises of South American business firms to see how long they keep their employees. One of the principal reasons for this is that the foreign firms pay good wages and look after the welfare of all their clerks. These employees know the language and customs of their customers, many of whom are large coffee Tazendeiros in Brazil, cattlemen and grain men in the Argentine, and nitrate of soda mine men in Chile. These customers are very large employers of cheap labor and they buy immense quantities of every conceivable kind of supplies and their credits are good for long time notes. Again all these importing houses have most of their head clerks out from the home office and they are all taught Spanish and Portuguese thoroughly before they arrive in the country. Extreme tact is needed to deal with the South Americans. They are the most polite people I have ever met. Politeness comes next to religion with them and it takes hours and sometimes days of patient attention and waiting on some of them to gain their goodwill, confidence and trade. One of the first words for anyone trading there is to thoroughly understand the Portuguese word Amanhã, which means to-morrow, and is generally used and means don't hurry me, I want time to make up my mind. It must not be forgotten that although the people of the cities are very lavish spenders, the bulk of the laboring classes are very poorly paid, as almost all the outside laborers of the interior are given small wages and a piece of land and sometimes a small share of profits, so it comes to be a case that about 75 per cent of the imported articles must be cheap and attractive. This is the reason that Germany has made such inroads into British trade. Britain made a good solid article built to last and Germany made an attractive cheap article which appealed to the low paid workers of the country. It has long been one of the principal drawbacks to American trade that our manufacturers and travelers did not thoroughly understand the language of the country; also in many cases the different business and credit methods of each. It is no use for a man to take a few lessons in Spanish and Portuguese and go down there and try to sell them goods for cash when they know they can go to their own traders and buy exactly the same American goods from the German and British on long credits through the banks who have trusted them for years. The South American business man is extremely sensitive and honest and it takes many months of patient labor to find out each customer's whims. If we are going after this trade it is high time we taught Spanish and Portuguese in all our high schools. Not many of our thousands of high school graduates know a single word of the above languages and once the boy leaves school he has missed his finest chance of learning a language. The future market of the world is South America, and it is absolutely necessary to learn both Portuguese and Spanish, as Spanish is useless in Brazil and Portuguese is of as little use in the other Spanish speaking countries. When the South American has a little money to spend he takes his family to Paris, London, Berlin and Rome where he has his exclusive clubs and hotels and they spend thousands of dollars, and are very often well entertained by the European side of the firms they trade with. It is all very well for our Government to make protective alliances with these republics, but that will not help trade. Trade has to be gone after, and worked up, and then held against the strongest competition.

I see that a company has been formed in New York and Boston with a capital of $10,000,000. Now if the Government would only pay a bonus for every ton of exports and a small bonus for every ton of imports to and from South America carried in American bottoms, it would give our steamer men some encouragement; without some help it seems almost hopeless. At present things look pretty good, but one of the principal difficulties is to obtain a full cargo both ways. Can we do that? At present we can, but after the war when the steamship lines once more become thoroughly organized (and do not let us imagine it will be any half measures), they will be more thorough than ever before. All the European countries have their large fast passenger steamers, that are floating palaces. They are smaller than the liners coming to New York, but in many cases have far superior accommodations. Then these lines have another fleet consisting of slower large capacity cargo boats, some of which carry a few passengers at lower rates. Then the British and Germans have small shallow steamers that go up the large rivers and dodge along the coasts and pick up cargoes for the larger steamers. These steamship companies had a pretty good understanding between themselves before the war and even though there is war between them now it is highly probable those rings will be renewed to a certain extent. In many cases cargo tramp steamers are chartered for a load of coal or goods from Europe to South American ports, then load up with a full cargo of coffee, hides, or nitrate of soda, for a United States port, then load with grain for Europe. I notice that nearly every American steamer has gone into the European trade and sailing vessels into the South American trade. Would it not have been more profitable ultimately to have paid more attention to South America and have had American steamers carrying cargoes from South American ports, instead of having almost daily arrivals at our ports of British tramp steamers with full cargoes from Chile, Argentina and Brazil, in spite of the fact that England is at war? It looks as if England for one intended to hold on to her trade in the South. Let us make our start at once or we may hang up the sign, "*Too Late.*"

E. ANDERSON.

Sebago Lake, Maine.

Durable Lead Coating of Iron and Steel

To the Editor of the SCIENTIFIC AMERICAN:

A letter received by me from the United States Consul at Bolivia and Peru, Mr. Donaldson, says that the Great Northern Railroad Company and the fruit, etc., shipping companies there, complain of the speedy destruction of galvanized roofing sheets on their buildings. In your supplement issue of January 1st, No. 2087, Mr. H. B. C. Allison gives among other processes of covering iron and steel goods, sheets, etc., the Lohmann process, it being a supposed good lead sheet for roofing purposes. Lead covering (*pure lead*) would be the ideal sheet for that market in South America. Mr. Allison describes the Lohmann process fully, and it says, that after cleaning the sheets, the sheets are put in a bath containing hydrochloric-mercurial and ammonia. The metal bath consists of *alloy metals;* now it has been found in tropical countries, near the sea coasts particularly, that any roofing sheets, having *a mixture* of metals covering, or spelter zinc itself, *that any metals but pure lead*, is soon oxidized. Having spent most of my life, as a coater of iron and steel, I know from reports from different sources that this is correct. Anyone interested in the *pure lead coating*, may please correspond with

D. R. JENKINS.

Youngstown, O.

A Billion Dollars!

To the Editor of the SCIENTIFIC AMERICAN:

A billion is a thousand millions, but this definition does not give a satisfactory conception of its magnitude, and it is necessary to find some way to make it clearer, for if, before this world's war, a million dollars was spoken of only with awe, a billion dollars has, today, at a jump, become an everyday expression in modern financial topics.

They say: the earth is 93 million miles from the sun; but we understand much better when we are told that the earth is distant 11,500 earth diameters from the sun, this unit of 8,000 miles (the earth diameter) being nearer to us.

Hence, let us try a kind of qualitative and quantitative analysis of a billion dollars by measuring it in time, weight and labor.

As to time:

In the year of our Lord 1901, on the 29th of April, at 5 h. 20 m. A.M., we would have completed a billion dollars, if, at each and every minute, a dollar had been struck and added to the pile until that date.

The length of the astronomical or solar year being taken as 365 days, 5 hours, 48 minutes and 48 seconds, it gives a year of 525,948.8 minutes:

		Minutes.
525,948.8 min. × 1901 years	=	999,302,720
1 year (calendar year of 365 days)	=	525,600
1,440 min. (24 × 60) × 119 days	=	171,360
60 min. × 5 hours	=	300
and		20
		1,000,000,000

As to weight in gold:

A gold dollar weighs 25.8 grains, hence:

$$\frac{25.8 \times 1{,}000{,}000{,}000}{7{,}000} = 3{,}685{,}714 \text{ pounds avoirdupois or}$$

1,645 long tons, a gold train of some 100 freight cars.

As to work:

It represents 200 millions working-days at $5.00 per day.

EDMUND BECKER.

Washington, D. C.

Experiments in Use of Niter Cake

IN the search for a substitute for sulfuric acid several of the mills in Yorkshire, England, have carried out a number of experiments in the use of niter cake. The purpose is to employ it in various operations in which sulfuric acid is ordinarily used. The *Yorkshire Post*, of Leeds, says that from the results of these experiments, which have all been made on a working scale, it is evident that niter cake can be used in place of ordinary sulfuric acid for the extraction of grease from either wool suds or piece-scouring suds, for the refining of grease, for the stripping of rags, except perhaps where light dyes are subsequently to be used, and for dyeing rags in the shoddy trade, more especially where dark colors are being used.

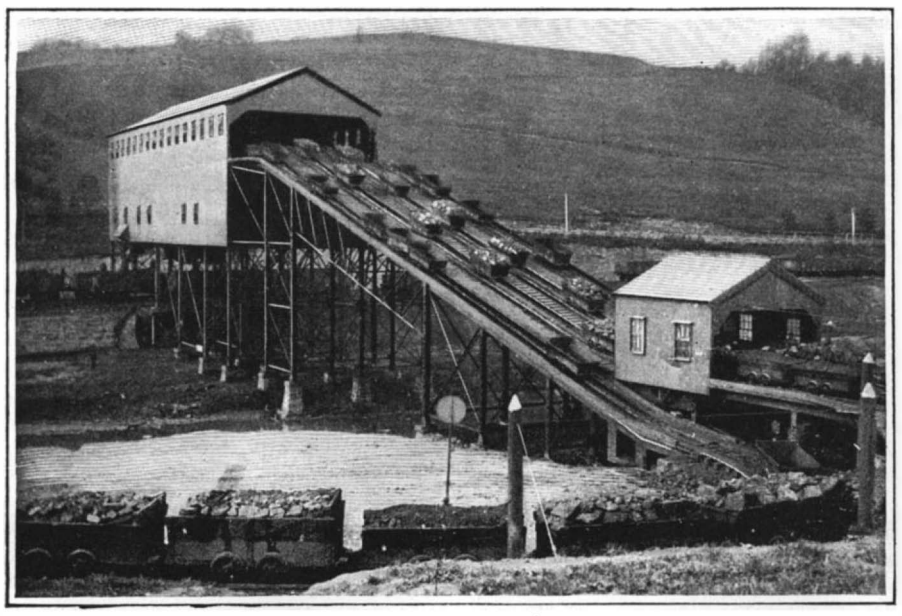
The *Post* states that certain difficulties in the use of the cake are presented, but that these can be surmounted. They are, chiefly, difficulty in handling because in larger quantities, as the cake contains only 30 per cent of its weight of pure sulfuric acid; draining of the acid liquid in storage and handling, and difficulty in transportation. It states that the best method of using the cake is to dissolve it in hot water by the aid of steam, and to use this solution while still hot.

New Apparatus for Controlling a Ship from the Bridge

DR. K. ITO, manager of the engine works of the Mitsu Bishi Dockyard and Engine Works at Nagasaki, Japan, has invented an apparatus for controlling the movements of a ship directly from the bridge, so states the *Commerce Reports*. This invention is likely to have the most far-reaching results and will undoubtedly be adopted by shipping companies in all parts of the world. The device does away with the necessity of telegraphing instructions to the engine-room. The new apparatus, which enables the officer on the bridge to regulate the valves or reverse the engines directly, can move the ship at will in the time it usually takes the engineer to receive the message by means of the telegraph indicator.

The new apparatus prevents the possibility of misunderstanding and error. In case of accident, disputes frequently occur between the bridge and engine-room as to the indication of the engine telegraph. The device may be used with great advantage in foggy weather or in going in and out of a harbor or in anchoring. The greater mobility which a ship thus attains will often enable it to avoid a collision. The racing of propellers in stormy weather frequently causes great damage to the engines. This, however, is said to be prevented by the new apparatus. The navigator can adjust the engines instantly before the big waves are encountered.

Unfortunately, details of the new device are not available at the present writing. It is known, however, that the device is worked by electricity and that in case of defect it can readily be detached and the engines worked in the ordinary way. This change does not require more than three or four seconds, according to reports.



Modern coal tipple, showing weighing house and inclined plane
In the earlier period of coal mining in this country, in some cases only 30 per cent of the coal was recovered. Under the best current practice we are recovering 85 to 90 per cent.

Electric mine locomotive pulling trainload of coal
It is largely by the use of improved mining machinery that the average American miner produces something like three times as much coal annually as the European worker.

Preparedness for Peace in the Mineral Industries

What is Being Done to Eliminate Waste

By Stuart B. Stone

WHEN the ruling forces of the Old World first let loose the dogs of war, spreading frightfulness and carnage over half the globe, business America stood aghast, half-stunned, afraid to move, to buy, to build, to employ. Stock exchanges closed; wheels and spindles slacked motion; pay-envelopes dwindled. Then gradually the truth began to dawn upon our tradesmen and producers that the end of the world had not yet come. First came the spurt of war orders, later to develop into a continuing flood. Then it was realized that, while great trading and manufacturing nations had put down the yardstick and the monkey-wrench for the saber and the hand-grenade, the black and brown and yellow peoples whom these warring nations had been accustomed to supply still required food and raiment, things to work with and things to play with, and were ready to buy these things—from nations not at war. The American consular agent, the American commercial salesman—and particularly as regards the mineral industries, the American chemist and engineer and metallurgist—got busy. The result in 1915 was an export trade of $3,555,000,000, exceeding the 1914 figures by 70 per cent, and breaking all previous records.

Secretary of the Interior Lane recently said:

With the exception of one or two minor minerals, the United States produces every mineral that is needed in industry, and this can be said of no other country. We produce 66 per cent of the world's output of petroleum, 60 per cent of its copper, 40 per cent of its coal and iron, and 32 per cent of its lead and zinc. We can build a battleship, a railroad or a factory entirely from the products of American mines and forests. To replenish the soil, we have phosphorus in abundance, potash is known to exist in the deposits of Searles Lake, California, and in alunite, deposits of which are found in several states; and nitrogen can be extracted from the air by cheap hydro-electric power. So that we can feed the earth and keep it sustained. And to crown all this we have water power that can be made to generate perhaps as much as 60,000,000 horse-power.

The questions now being asked are: "How can this nature-favored nation be rendered commercially near-independent—self-supporting, with tidy surpluses for export?" "How is this new and lucrative world-trade to be held?" "How shall 'Made in U. S. A.' continue to be seen from Mandalay to Callao?" "How shall we prepare for peace?"

This can be done, so far as the mineral industries are concerned, only by economical, efficient and honest methods of production, utilization and distribution.

The present cry for mineral conservation only accentuates and accelerates the movement which really received its first notable impetus from the Conference of Governors called by President Theodore Roosevelt in 1908. Up to that time, it has been said, the nation was lighting its cigars with ten-dollar bills; skimming the cream of its God-given resources and throwing away the slightly-less rich residue; spending its stupendous mineral wealth with the abandon of a drunken sailor scattering coin the first night ashore. A little coterie of Roosevelt's lieutenants—men like Joseph A. Holmes, Gifford Pinchot, James A. Garfield and Frederick H. Newell—kept the sentiment moving, and the idea has made progress steadily since that time. Two bureaus of the Department of the Interior—the Bureau of Mines and the United States Geological Survey—are doing notable things for the mineral industries.

Burning of 55,000 barrel oil tank, struck by lightning at Tulsa, Okla.
Fires from lightning or other causes have resulted in enormous loss of stored oil or oil from flowing wells

In discussing mineral waste, Dr. Charles L. Parsons, chief chemist of the Bureau of Mines, has summarized:

Wastes in mineral production and treatment are of many kinds. In the process of mining, some of the material is inevitably left in the ground, being of too low grade to work with profit, or being necessary for roof supports in the form of pillars. In ore dressing and ore concentration the losses are often startling, and in spite of advances in the last few years, this field offers broad opportunity for the investigator. Many ores formerly of too low grade to pay for extraction are now sources of wealth, and care should be taken to leave low-grade deposits in position for future development whenever conditions warrant. The dust from stacks and chimneys of all kinds is often not only a great waste of valuable material, but is one of the great evils of modern civilization. Losses are caused by the use of material entirely unfitted for the use to which it is put. Failure to use resources, the value of which is unknown, gives rise to economic inefficiency. New forms of machinery will reduce costs, and entirely feasible precautions will lessen the danger to life and limb.

In the past there has been great waste in the mining, transportation and use of coal in the United States. Much of the mining was carelessly done, and it is estimated that fully 2,000,000,000 tons of anthracite and 3,000,000,000 tons of bituminous coal have been left in the ground in such a manner that the possibility of its future recovery is problematical.

We are the largest consumers of coal in the world, using 40 per cent of the world's annual production. Probably not over 11 per cent of the energy in coal is effectively utilized, the remainder being lost through the inefficiency of the steam boiler, the steam engine and the electric dynamo. It is estimated that the boiler scale in locomotives alone in this country means a loss of over 15,000,000 tons of coal annually.

One of the efficient methods of conserving our coal supplies is through the utilization of water power. Furthermore, the development of the gas engine, by means of which energy of fuel can be utilized without the intermediary loss involved in generating steam, is rapid. The scientific control of the combustion of coal under boilers is greatly increasing the amount of energy actually utilized, but the losses of carbon that is still pouring from our chimneys, defacing buildings and landscapes, are without justification.

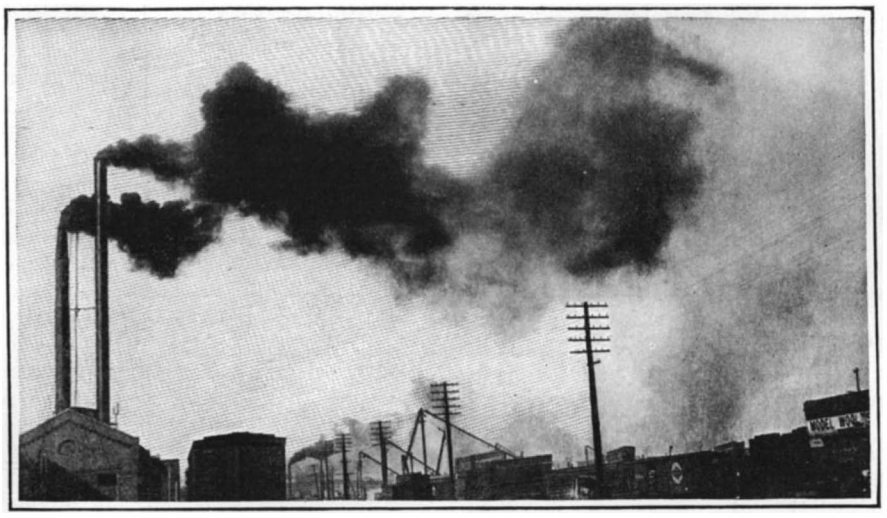
Nearly three fourths of our coke is made by the wasteful beehive process. Slightly over one fourth is manufactured in ovens of the by-product type, which permits recovery of gas, tar, ammonia, benzol, and other products. The value of recoverable products wasted in beehive ovens in 1913 was estimated at $45,000,000. Another source of waste is the coke breeze. In the coke regions where the old method is used, the breeze, which would make excellent fuel for hot-air furnaces in residences, lies in immense piles, unless indeed it is burned as fast as made.

The total value of the oil and gas produced in the United States for the calendar year 1914 was more than $300,000,000. The total waste in all branches of the industry probably amounted to $50,000,000. Natural gas is an ideal fuel which has been grossly wasted. In

one state from 250,000,000 to 500,000,000 cubic feet of gas has been wasted daily, 80 per cent of which might have been easily preventable. The Bureau of Mines estimates that through its efforts $15,000,000 worth of natural gas has been saved in the single state of Oklahoma. More efficient utilization and the prevention of much waste will prolong the life of the oil fields for many years. Vast deposits of oil shale in Utah and Colorado, which can furnish 10 to 60 gallons per ton of rock, constitute an enormous undeveloped reserve of petroleum, and investigations by the Bureau of Mines and the Geological Survey are under way looking to the ultimate utilization of these reserves. Formerly kerosene was the chief product sought in the distillation of petroleum, and immense quantities of the lighter and heavier fractions were thrown away. Now, however, almost the total output of petroleum is utilized as gas, gasoline, naphtha, benzene, kerosene, lubricating oil, asphaltic road material, and carbon for electrical purposes. By means of the processes recently discovered by Dr. W. F. Rittman, benzol, toluol and other compounds used in the manufacture of dyes and high explosives can be extracted from crude petroleum. Dr. Rittman has also devised a process which will enable refiners to increase the output of gasoline from crude petroleum 200 per cent or even more.

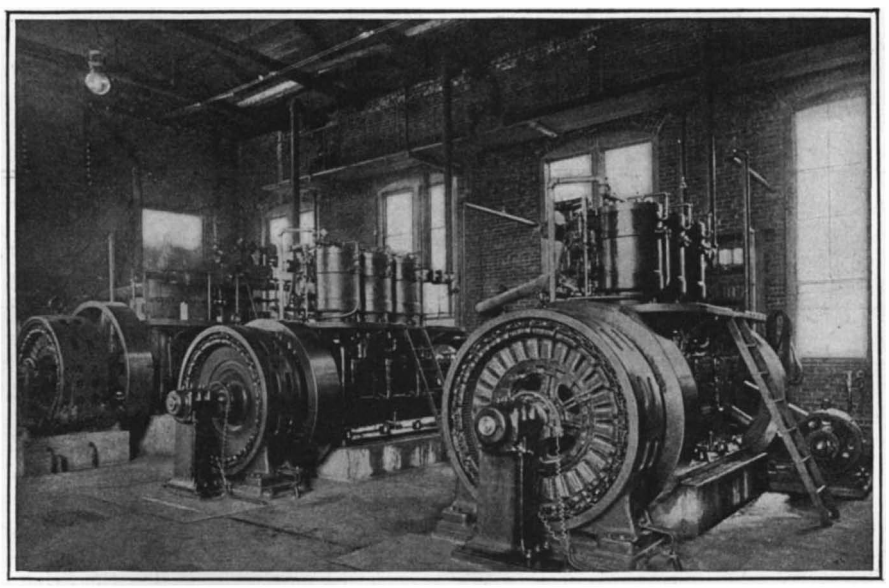
The metallurgy of iron has reached a perfection beyond that of any other metal. The poorer ores are being reserved in a condition available for future use; the methods of the blast furnace, the steel mill, and the foundry have been rapidly attaining high efficiency; most of the waste gases and the flue dusts are being utilized; and the slag is converted into Portland cement at the rate of about 8,000,000 barrels a year. Immense as is the available supply of iron ores of present-day commercial grade in the United States, it is not sufficient to prolong production for many decades at the rate of increase in consumption of ore that has obtained thus far. Means should be devised for the utilization of the titaniferous ores, of which there are immense deposits not now available by reason of the metallurgical problems involved. Many millions of tons of low-grade siliceous ores lie unworked in the Birmingham district, which the Bureau of Mines has shown can, by fine crushing and washing, be concentrated profitably. There is an opportunity for invention of processes by which ores may be smelted electrically by the use of cheap water power or reduced by the use of fuel oil in regions where good coal is scarce. There are also excellent arguments in favor of encouraging imports of iron ore from Cuba and South America, as a means of increasing trade between the United States and those countries and of conserving the ore supplies of this country.

With the advent of the steam shovel, improved mining methods, and recent advances in concentrating, immense low-grade copper ores are now worked at a profit. Three mines alone now produce about 300,000,000 pounds of copper annually, worth, at 15 cents per pound, $45,000,000. Under the mining and metallurgical methods of 20 years ago, this wealth of copper would have remained in the ground. The extraction of copper by hydrogravity concentration has averaged about 70 per cent. This means that in the United States about 340,000,000 pounds of copper went out with the tailings in 1914, which, if not recovered, means a loss of about $51,000,000 a year. Almost inestimable losses of sulphur, arsenic, bismuth, etc., are now taking place in the flue dusts and flue gases, but there can be but little doubt that these will be controlled in time.



Smoke!

Competent authorities have estimated the annual loss in the United States from smoke, in the way of defacement of buildings, damage to health, necessity for more frequent painting of buildings, etc., etc., at $500,000,000. Besides smoke means heat-energy lost. Proper combustion methods will practically eliminate this loss and nuisance.



Gas-producer engine

These engines allow the utilization of low-grade coals, lignite and peat, eliminate smoke, and avoid great loss in heat-energy of the coal consumed.

In proportion to output, the losses of zinc are probably greater than those of any other metal. Generally speaking, it is probable that less than 50 per cent of the zinc reaches the form of spelter. Zinc mining is frequently done on a royalty basis, an arrangement that means great waste because the lessee naturally takes out the ore paying the greatest profit and leaves the poorest ore behind without reference to its ultimate loss. The losses continue in the utilization of zinc, especially in the manufacture of brass, in which the annual waste amounts to more than $4,500,000, half of which is preventable. It has been estimated that 15,000 pounds of zinc escape daily up the stacks of the brass-casting shops in Waterbury, Connecticut, alone.

In treating gold ores by amalgamation followed by cyanidation, about 90 per cent—and in some instances 96 per cent—of the gold content is now recovered. Since 1896 by the use of dredges, largely an American innovation, about $100,000,000 in gold has been recovered by reworking gravels or working gravels that were too low in gold to be profitably mined by any other method. The new government railroad into the interior of Alaska should so cheapen costs that many placers from which the cream of the gold has been taken can be reworked and many placers that could not be profitably worked before will now contribute to the output.

Vast quantities of low-grade complex ores, carrying silver with lead, copper, or zinc, are now unworked in the metal-mining states of the west because of the lack of processes by which the metals can be recovered at a profit. Investigations are in progress under the direction of the United States Geological Survey and the Bureau of Mines to determine the extent of these ores and the possibility of developing processes for treating them profitably. Experiments are being conducted by the Bureau of Mines for perfecting details and cheapening the cost of cyanide treatment, which in the Tonopah and other districts has permitted the treatment of low-grade ores which otherwise could not profitably have been shipped to smelters.

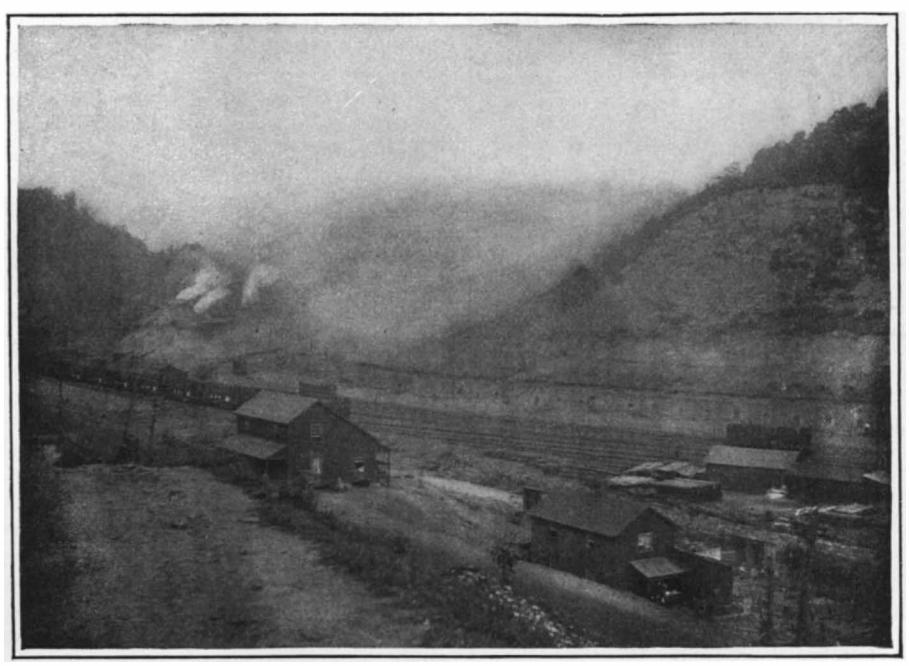
Every effort should be made to search systematically for platinum in the placer and ore deposits of the western states. New devices on gold dredges are saving much more of the platinum than heretofore, and further improvements seem likely. British and American capitalists are beginning to develop the platinum deposits of Colombia, in South America, the refining of which in this country would be a boon to the United States.

The United States consumes more tin than any other country in the world, and at the same time produces practically none. A domestic source of supply is badly needed. Alaska produced 100 tons per year for the past three years, and this field is worthy of further development. The opening of the Panama Canal should make possible the development of an extensive smelting business in this country, using the Bolivian ores, which have heretofore been sent to England because of lack of fuel in Bolivia for smelting.

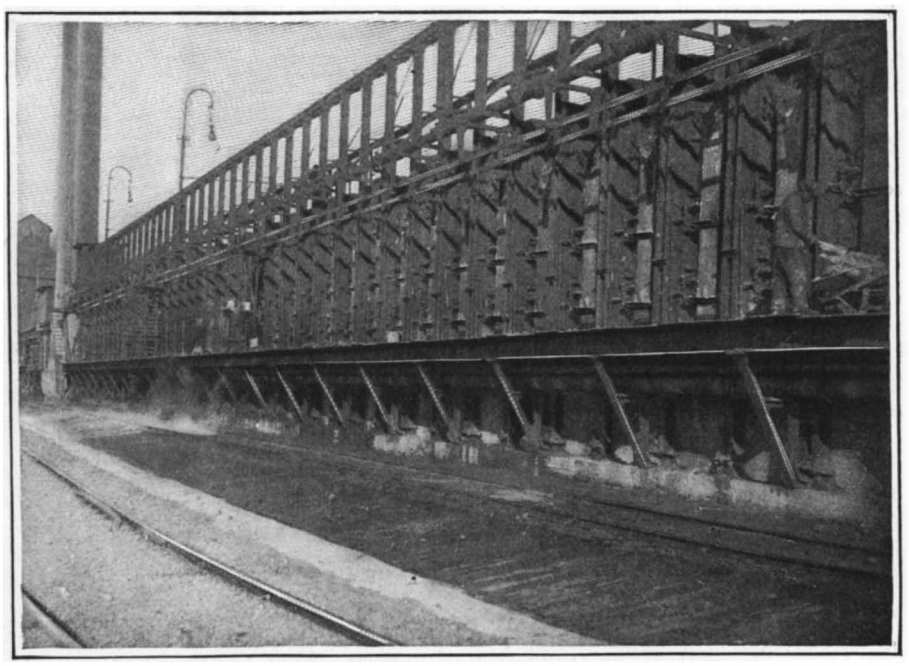
Improved metallurgical processes and the use of oil flotation in milling should enable the states of Missouri and Idaho to develop extensive low-grade deposits of lead ores and make the country absolutely independent of foreign countries for this metal.

Aluminum is still obtained from but one ore, bauxite, which is needed for other purposes. Any method for producing aluminum cheaply from common clay, which contains 10 to 39 per cent alumina, would be of inestimable advantage. In some melting processes in aluminum factories the average loss is 30 to 40 per cent.

(*Concluded on page* 360)



Battery of the obsolete and wasteful beehive coke-ovens, in which three fourths of our coke is still made, entailing an annual waste of more than $45,000,000



Battery of by-product coke-ovens, which save the exceedingly valuable gas, tar, ammonia, nitrogen, benzol and other products. This type of oven is rapidly replacing the wasteful beehive oven

War Game—III

The Advance to the Battle Field

By Guido von Horvath

IN its essential parts, the small combat and the greatest battle are identical. In a small combat, a detached engagement, the issue is soon decided and the result is decisive. In a great battle, made up, as it is, of a series of smaller engagements, the issue may be in doubt for a considerable time and the results difficult to determine. In all cases, however, the commander, in making his strategical or tactical plans, must consider the same elements: the fighting forces under his command; the terrain—the field of action; and the time element—the limits within which he must act to get the results planned.

To illustrate this we must refer to Colonel K's detachment. This detachment consists of four battalions of infantry, one battery of field artillery, one platoon of engineers, and the trains. These are the active fighting forces. The terrain shown on our map and in the perspective is the field of action. Time is the important factor which we must consider in planning to bring our fighting forces on the field of action into the positions which the situation demands.

It is evident that no one of these three elements can be slighted. While the issue is decided by the fighting forces, their action is limited by the terrain and the time allowed for the accomplishment of their mission.

Before going into the details of the present Game we must know something of the principles of the development of a fight or combat. In our problem we have reached the stage where we have information of the strength of the enemy opposing us. We also know that this invading force is advancing with the evident purpose of bringing on an encounter. We are therefore about to come in contact with the enemy. Our advance cavalry is already in touch with him.

In War Game II we saw the work of the Advance and Flank Guards. Now that we are advancing with the information of the strength and the aggressive purpose of the enemy, the service of security on the march will naturally gain in importance. It is necessary to exercise greater vigilance, if such a thing is possible, to guard against surprise movements by the enemy. This may be done by strengthening the advance guard and by making closer the screen of the flank guard.

Colonel K's detachment will move forward to accomplish its mission under the cover and the security furnished by its advance guard.

It must always be assumed that the enemy invading force acts in such a manner that his advance is as well protected as is our own, and that his independent cavalry and patrols are covering his front. Therefore, skirmishes may be expected between the opposing security forces.

Ordinarily, our independent cavalry will have completed its mission by the time this stage is reached. It would then become available to assist in delaying or defeating the hostile advance troops, and also in further reconnoitering and harassing the enemy's main forces.

Successes in the early stages of the advance are very important. They gain for the advance guard commander liberty of action and give him the advantage of the initiative, and thus an opportunity to impose his will upon the enemy.

Once this stage has been reached by the opposing forces, the commander of our detachment must make up his mind as to his further actions. He must then put his decision into the form of precise orders. In forming his plans there are four possible courses of action open to him:

1. To maneuver so as to gain time or advantage of position;
2. To avoid an engagement;
3. To attack the enemy;
4. To take a defensive position and await the enemy's attack.

Before deciding on our plans we must know something of the ways and means of actual fighting.

We have previously stated that the company fights in line, but we did not go into the details. Now we must take up these details in order to get a complete understanding of the task in hand.

Deployment for Combat

The different arms of the service, infantry, cavalry and artillery, all have their own ways of fighting. To a degree these ways are similar, but nevertheless each arm has a precise rule, based on its own weapons. We shall therefore consider them separately.

The Infantry. The infantry fights both with rifle fire and with the bayonet. Therefore, its deployment or, to speak in non-military terms, its fighting formations are such as to give the best opportunity for this fire, and for the bayonet attack at close range. We must consider here that it is possible that infantry fire may be employed at about 2,800 yards. This is distant fire, and is advisable only against large targets; 2,000 to 1,200 yards is termed long range; 1,200 to 600 yards, effective range. Close range means that we are firing within 600 yards of the enemy.

In order to show the method of deployment we shall work out the action of the company which has just advanced to within distant range of the enemy, about 2,800 yards.

The company takes a line formation. If a sufficiently large target should offer itself, volleys might be fired by the platoons, one after another, from covered positions. Should this fire not be taken up, the advance against the enemy from this point on would be made in formations different from those already explained. We are describing here nothing but the attack of a single company of infantry acting alone.

As soon as the company goes into action, from 2,800 yards on, it must deploy—that is, extend its front. This means that it must take a formation which admits the best use of fire, involves the least exposure to enemy bullets and provides a sufficient momentum for the advance. The platoons, as we have said before, are divided into squads. At the company commander's order, one or two platoons, as the case may be, will take an open formation and advance. (See diagram.)

Thus one half of the company is changed into a single line, with considerable distance between the men and a greater distance between the squads, about 150 or 200 yards ahead of the remaining two platoons. The result of this movement is that the first and fourth platoons have formed a skirmishing line, while the other platoons form a company reserve. Quite naturally, the thin skirmish line is the firing line.

From this point on the combat will consist of alternate firing and advances, with the best possible utilization of the natural protection offered by the ground. Once within effective range, the platoons will move forward alternately, so that the fire of one platoon will cover the advance of the other. In the later stages of the attack it will be necessary to fill in and strengthen the firing line with part of the reserves. But the company, when acting alone, must always retain at least one platoon in reserve in order to carry through the bayonet attack.

What we have here shown for a single company will also serve as an example of the actions of larger units. The main difference will be in the size and composition of the reserve. Every command will retain a portion of its force to act as a reserve to be used in pushing the advance and to give the weight at the time of the final thrust.

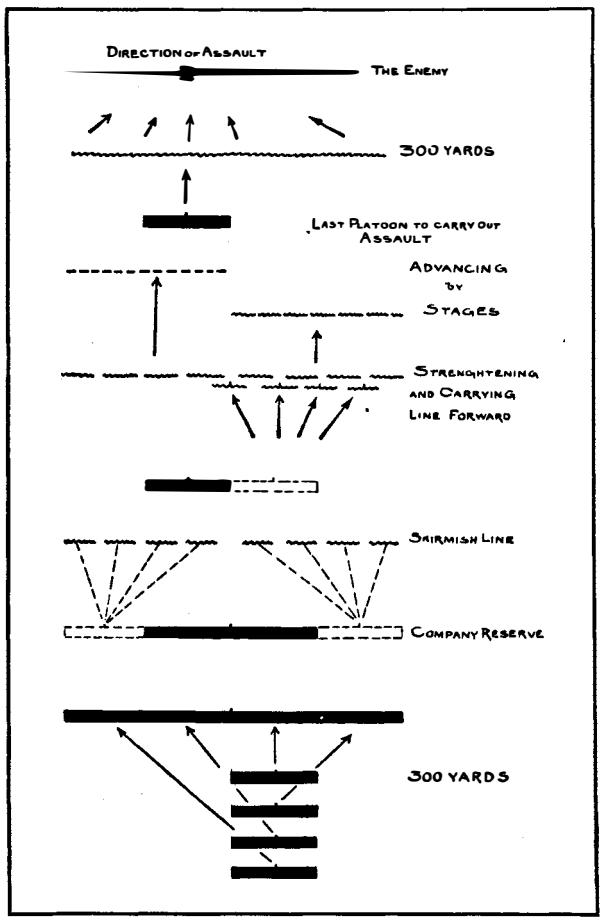
In considering the special task of our detachment there will be used company, battalion and detachment reserves. The further details we will work out as the various problems are solved.

The Cavalry. The duties of the cavalry are in many ways different from those of the Infantry, yet, in case of need, the cavalry can successfully undertake infantry action. In such a case it dismounts and acts exactly like infantry.

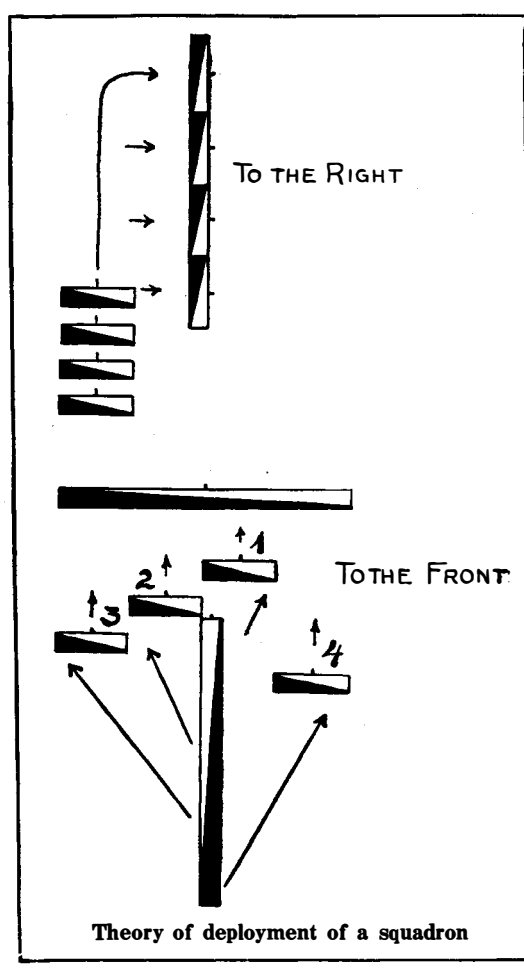
The service of reconnaissance is not and should not be a fighting task, although it will at times be very hard to avoid scrimmages. When cavalry, in larger units, carries out a reconnaissance in force the skirmishes with the enemy cavalry will be numerous. Cavalry has a simple method of attack against cavalry; the attack is made in line and with increasing speed; the enemy is rushed. The force of impact, as much as the work of sabres or pistols, will have great influence in winning the victory. Against infantry, a skirmish charge has to be made, and it can succeed only when delivered as a surprise. The chief uses of cavalry, aside from reconnaissance, are the harassing of an enemy's flanks and rear, covering and screening

THIS series of war games began with the issue of March 11th, which deals with a Strategic Reconnaissance of Four Cavalry Patrols. The second war game was published in the issue of March 25th and dealt with the Service of Security on the March and at the Halt. In each game problems were presented, the answers being published in the succeeding installment. Answers to the problems presented in the present installment will be found at the end of War Game IV, which will be published in next week's issue of the SCIENTIFIC AMERICAN. *Copies of the enlarged colored map covering the terrain of the war game may be procured at 10 cents each.*

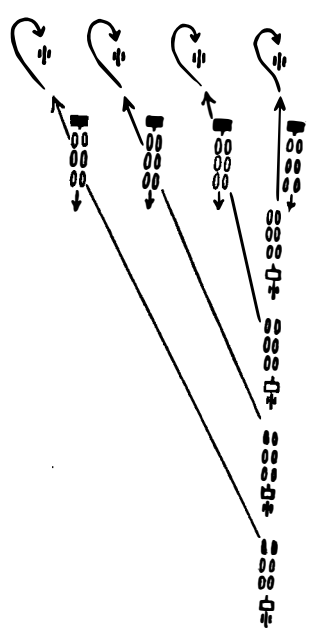
EDITOR.



The theory of deployment, fire combat, advance and the final assault by a company



Theory of deployment of a squadron



Deployment of a battery of four guns

the movements of the main body, and securing in advance favorable positions for the slower moving infantry. (See diagram.)

The Artillery. This is the most important branch of the army; but, deadly and powerful as it is, it always demands the protection of Infantry or Cavalry, for once approached by the enemy, it cannot defend itself.

The Artillery has but one way of promoting the final success of an engagement: its fire effect. The effective range for field Artillery is inside of 4,000 yards, although it is able to throw its missiles 6,500 yards or more. Field Artillery is almost as mobile as Cavalry; therefore it can be placed at the desired point on short notice.

It is very important that the reader understand that the Artillery is *not in line with the Infantry*, except in extremely unusual cases, but always behind the firing line, often at a considerable distance. The shells and shrapnel are fired over the heads of the advancing Infantry.

To aim a gun it is not necessary for the artillerymen to see their target; they are always directed by officers from observation points. In order to hit the mark, the direction of the target and the distance in air line must be known. Once these factors are known, the elevation and deflection of the gun is given and, at the command of the observing station, or, if the target is in sight, as in direct fire, at the command of the commanding officer, the gun is fired. The accuracy of artillery fire is remarkable and its effect may be very great.

As far as our present problem is concerned, it is enough to know that there are two kinds of shells in use: the high explosive and the shrapnel. The first is constructed with a mechanism which bursts the shell at its contact with the ground or any resisting object. The shrapnel is provided with a time fuse, which is set before loading and which explodes in the air at the desired distance, throwing several hundred bullets, and sometimes the broken fragments of the shell, against the target.

Under any circumstances, the commander must provide for adequate protection for his artillery. This protection can be either Infantry or Cavalry.

The placing of artillery in the field will be clear from this illustration:

All this understood, we are ready to take up matters with Colonel K's detachment.

Situation

At 6 A.M the detachment is in marching order. A train, with supplies, has arrived during the night from the south. Colonel K, at the northern edge of the village, with his map in hand, after a brief study and consideration, gives the following verbal order:

His Staff and Battalion commanders are present.

The enemy, three battalions of infantry and one battery of artillery strong, is marching on Pottstown. Its advance guard has just passed the big pine tree on the Nohaminy River. A few of his patrols are reported on the left shore.

Our division is approaching from the south.

Our detachment will advance to secure the bridges northeast of Pottstown, and to occupy Lookout Hill.

Our independent cavalry will harass and delay the advance of the enemy.

On account of the nearness of the enemy to the bridges, the First Battalion will immediately board the waiting supply train, cross to the right shore and hold same.

The Second Battalion and platoon of Engineers, as Advance Guard, will cross Conestoga Creek at railway bridge and will follow the railroad until the road leading to the Pottstown Island bridges is reached. Thence to Lookout Hill, where communication and coöperation with the First Battalion must be established.

I will be with the Reserve of the Advance Guard.

* * * * * *

To Captain C, independent cavalry, the following order is sent by heliograph:

"Detachment will reach Nohaminy bridges at 9:00 A.M. One battalion by rail at 7:30 A.M. I propose to occupy and hold Lookout Hill. Delay enemy's advance until 9:00 A.M.

Considerations

Colonel K's orders are based on the information he has received from the Advance Cavalry, and from his orders from the Division Headquarters.

The development and the working out of this situation is somewhat complicated by the fact that the enemy is slightly nearer to the points which Colonel K wants to reach than is his own detachment.

The train, therefore, is used to overcome the influence of distance.

The Colonel is quite justified in using this emergency measure, and, under the existing circumstances, it can be undertaken with rather good chances for success. He knows that only small enemy patrols are on the left shore of the Nehaminy River and that the Advance Cavalry serves, to a certain degree, as an Advance Guard. Besides this, the time and distance are such that this separation of the battalions will be for a short time only.

We must also consider one important thing which will have some bearing on future developments. This is the fact that our detachment marches on roads, whereas the enemy, in order to reach Pottstown from its present position, has to march across country without roads, until the Greenville Road is reached. There it crosses Timcum Creek on the railroad bridge. This bridge might not permit the passage of artillery, and eventually might force the enemy to a detour and the use of the two other bridges northwest from the railway bridge.

Therefore, the main problem lies in the dispatch with which the greater distance is covered. To this end, the train is used, as well as the order to the cavalry to harass and delay the enemy in its march.

As a matter of course, every commander must consider that the enemy forces will be utilized with similar intents.

Developments and Questions

The plan of outpost service shows the situation of the detachment at 6 A.M. Now here are certain important phases which must be understood before we can go further in our game. One of these is: What shall become of this outpost line? How will these scattered troops act to fall into column of march with the rest of the forces? It is understood that at 6 A.M., when things began to happen, the elements of the outpost were still at their respective locations.

Question 1. Figure out the road or direction by which A Company will fall into line of march. B Company? The outpost reserve, which was C and D Company?

It must be considered that the commander of the 3rd Battalion was present when Colonel K gave his orders for the march, therefore this commander's duty will be to immediately issue orders for the assembly and relief of the outpost.

* * * * *

Question 2. Formulate an order which will be adequate to bring about the relief of the elements of the outpost.

Composition of orders of tactical nature must be made with the following points in view.

1. The enemy.
2. Our own intentions.
3. The disposition of troops of our own unit to carry out our intention.
4. The place where commander can be found.

* * * * *

At 7:30 A.M. the train carrying First Battalion reached the southeastern fork of the railroad near Pottstown. There the train halted. A few minutes later a rather heavy explosion was heard, coming directly from the north.

Question 3. Account for the explosion.

* * * * *

The First Battalion commander decides to disembark his battalion at once, and to cross the river via the island bridges.

Question 4. Since his orders demand from him the securing of the bridges east of Pottstown, how will he proceed to secure these thoroughfares of great tactical importance?

The main question here is to find the right way of occupying and holding these two bridges. The terrain must be very closely considered and also the means by which infantry holds a position. Consideration of these two elements and of the strength of the forces in hand and to follow will determine whether to go beyond the bridges and choose a position blocking the approach for the enemy; or by preparing trenches and utilizing the river as a serious obstacle to defend the southern bank around the bridges.

The first way is a positive achievement, the second a passive defence.

* * * * *

Question 5. Provided the commander of the First Battalion has decided to push forward immediately, what will be his order, and his first aim?

Consideration must be given here to the orders issued by Colonel K at Norrisville and to the topographical situation.

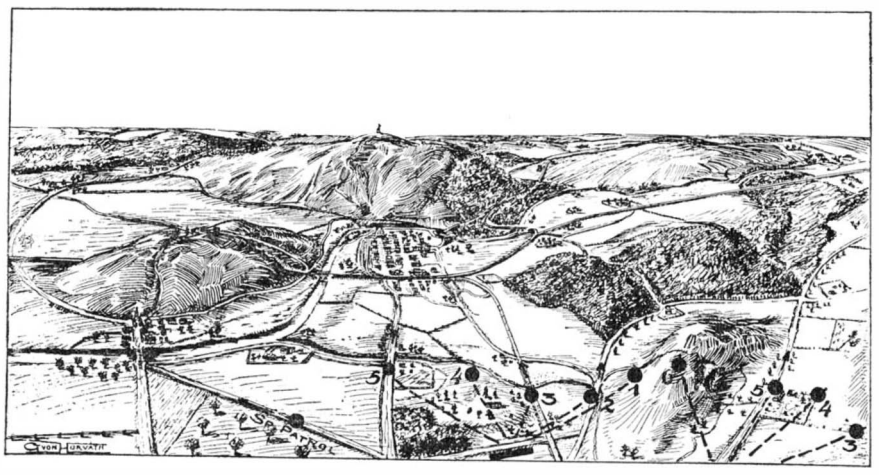
Question 6. The First Battalion has reached Argus Farm on top of Lookout Hill. What will be the Battalion's tactical formation?

Consider the nearness of the enemy, the dangerous wooded slope marked "Pine Forest," the road and railroad leading through these woods, also the fact that the railway bridge is to be covered.

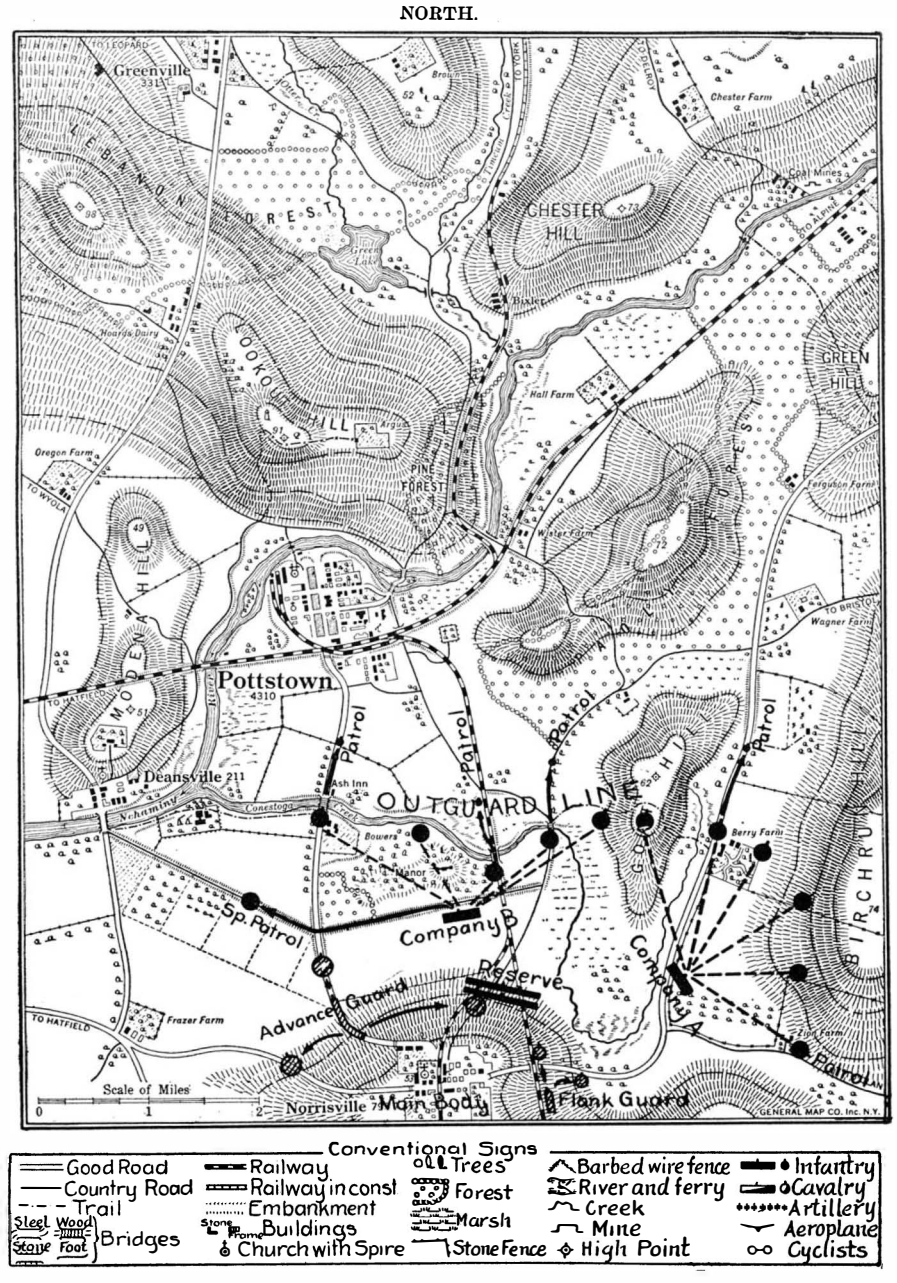
Question 7. Mark the position of Colonel K's detachment on map at 9 A.M.

Carefully consider diagrams showing the deployment of a company for combat and the possible application of the same to the topography of the field of action.

(*Concluded on page* 364)



Bird's-eye view of terrain depicted below



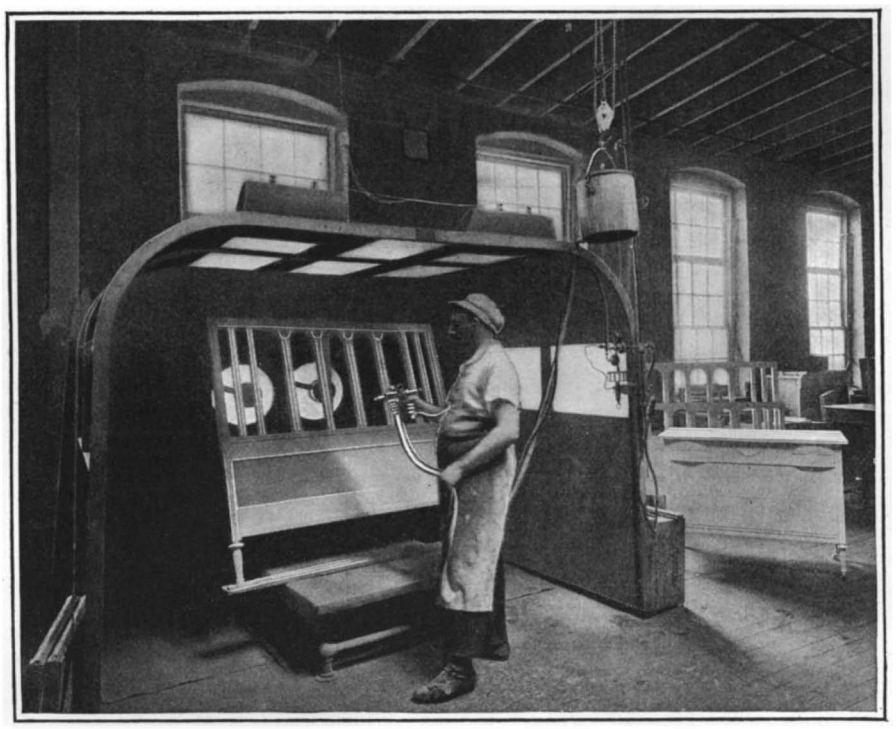
Map illustrating the advance to the battlefield

Finishing Furniture with the Use of Compressed Air

IF you should make a trip to some modern furniture factory you would be disappointed if you expected to see men putting varnish, enamel and other first-coaters on their products with a hand brush. Times have changed. Hand brushes are too slow and inefficient in these days of quantity production, and compressed air has taken the place of the hand-brush worker.

To-day you see a bedstead entirely coated with a varnish-gun in less time than it takes to describe the process and all done in so scientific a way that fumes from the material are removed—in fact, all dust and loose dirt are removed from the article by compressed air as the varnish is applied. The hose receives its supply of material from a container hung by a safety arrangement above the head of the workman. Gravity causes the material to flow into the nozzle of the apparatus. Here it is properly mixed with compressed air so that a delicate, fine spray or a heavy one is at the disposal of the workman.

There are hundreds of factories using the new system for placing finishing material on wood and metal parts. Automobile bodies are treated with the finishing material by this process. In case of large articles, they are placed on a turntable inside a protected area, or what is called the "fumexers." By a specially-designed exhaust apparatus all fumes are removed from the finishing room, insuring better health conditions for the men.



Workman applying varnish on furniture by means of a varnish-gun. The hood in which he works is equipped with exhaust fans

A Mechanical Method for Scraping Motor Bearings

TO perform mechanically the tedious work of hand-scraping the babbitt or bronze bearings of automobile motors and other machinery, is the purpose of an aligning reamer recently perfected by a Massachusetts manufacturer.

Hand-scraping the crank shaft bearings of an automobile motor usually requires from three to five days. Each bearing must be scraped with a hardened steel scraper, and while bringing it to size the mechanic must be careful that the metal is removed in such proportions as to bring the bearings in final alignment, and located so that the gear on the crank shaft which drives the cam shafts will mesh perfectly with the gears on the cam shafts. The mechanic accomplishes this by applying "Prussian blue" or some coloring material to the journal of the crank shaft and taking "prints" of the bearings. This process, often repeated, consumes several days.

By the new mechanical method, however, it is possible to ream the bearings of a motor in one day or less, producing bearings accurate in size, perfect in alignment, and having smooth, burnished bearing surfaces. An aligning shaft longer than the crank case of an automobile motor is set up in the bearings, supported by means of adjustable eccentric bushings having finely threaded tapered sleeves, which screw into the softer metal of the bearing lining. By manipulating these eccentric bushings, the shaft may be first located to insure gear mesh and then aligned from bearing to bearing.

The reamer head, which may be held at any point on the aligning shaft, is set with a micrometer to an exact size determined by calipering the crank shaft journals. The bearings are then reamed out in succession, operating the reamer as an ordinary hand reamer. The blades of the reamer head are formed so that the bearing is not only bored out but the surfaces are burnished. This does away with the necessity for a long "running in" of the motor which is usually required after hand-scraping to wear down to a good bearing surface. The illustrations show how readily the reamer may be set up and operated. On some types of cars, a burned-out bearing may be replaced and aligned with the other bearing or bearings, without removing the engine from the chassis.

Method of using the mechanical belt lacer

Mechanical Belt Lacer which Replaces Manual Belt Lacing

SPLICING of belts by skilled workmen is in a fair way to become obsolete. There is another and better way. A machine has recently been put on the market that does this work so perfectly and efficiently that the joint made has a tensile strength of 2,000 pounds.

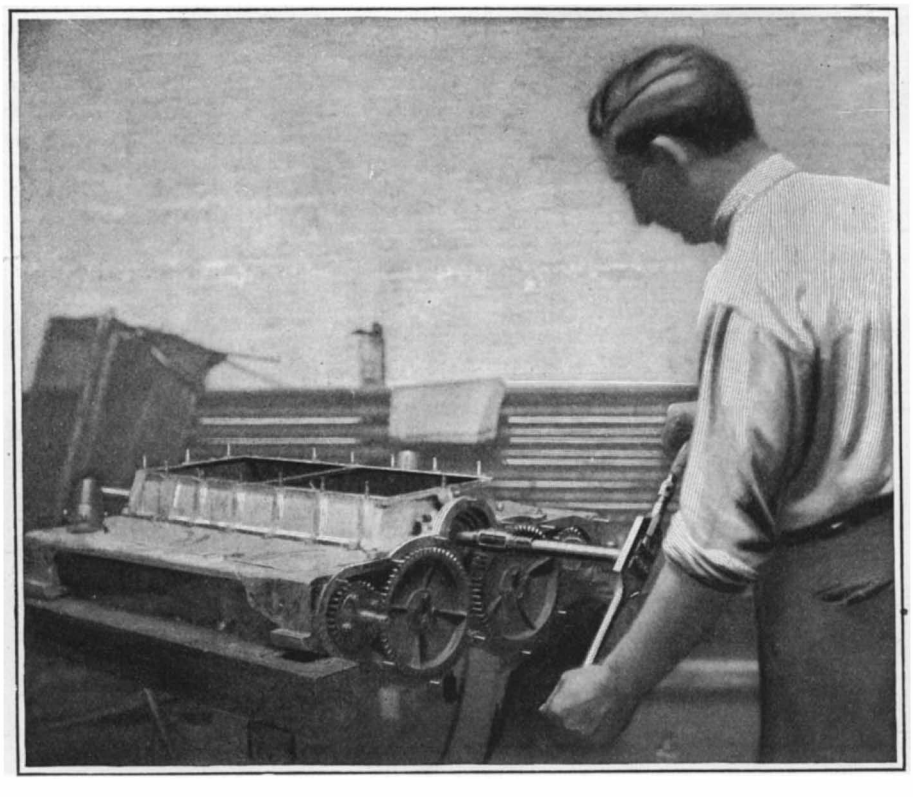
But one man is required to accomplish the hardest job of belt splicing with the new machine. The joining together of the parts is in the form of a hinge joint, and pulleys small in diameter have no terrors for it. No jerking, slipping or other vibration is experienced with a splice made by the mechanical splicer.

The operation of the machine and the apparatus itself is interesting and represents the thought of some mechanical genius. It is as follows:

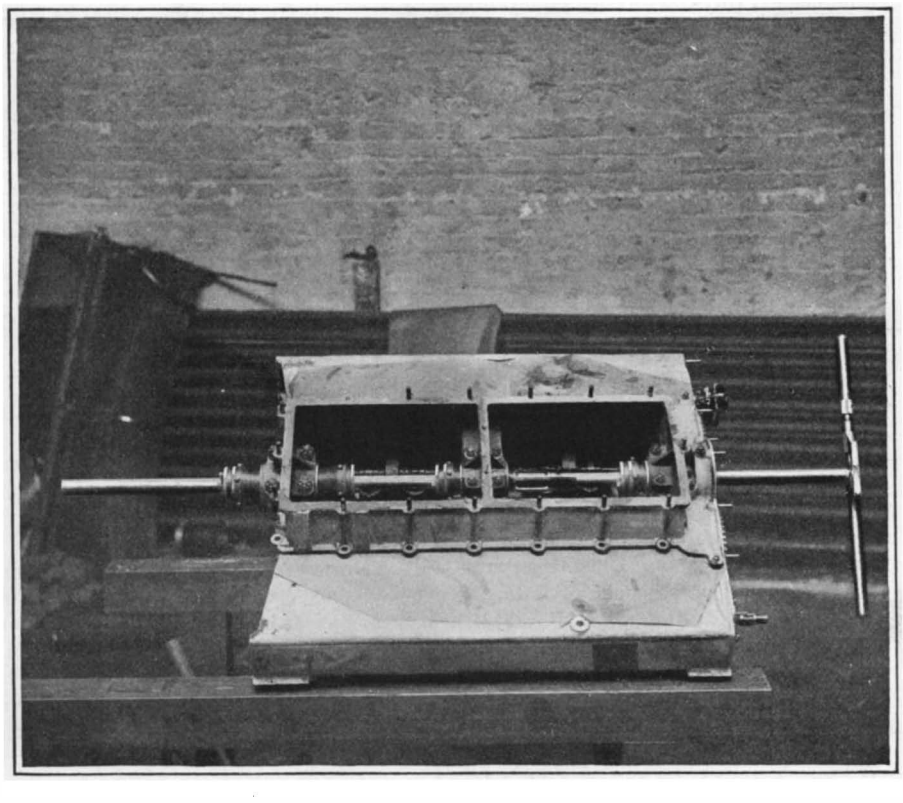
Three corrugated rolls are operated by a crank. Between the rolls a spiral needle is inserted, and when the crank is turned it is carried through the ends of the belt, making perforations of very small diameter. After this first operation, wire lacing is run through the perforations in the same way the first operation was performed. After these operations the coils are flattened and forced far into the belt. By this method loops are made, and by raw-hide pins these are coupled together. With this last operation the lacing is complete.

Besides saving time for the man who owns one of these worthwhile machines, there remains yet another point to its advantage. Numerous small pieces of belting are from time to time cast aside for the reason that a belt pieced together by hand from small parts would be too expensive and, more important still, would not be efficient. The mechanical lacer joins such parts easily and thoroughly, resulting in an easy run and as smoothly as some others composed of longer sections.

The machine has been mounted on wheels, permitting it to be taken to the scene of action, instead of bringing the belt to the machine. In some cases it can be equipped for power operation.



Reaming bearing No. 1. Note that aligning shaft has been accurately located to insure perfect gear mesh between crank shaft and cam shaft gears



Reamer head in position to ream bearing No. 2. Note that adjustable bushings which support shaft are screwed into soft metal of bearings

Fencing Tournaments for Blind Men

Latest Parisian Fad Which Affords Much Pleasure to Participants and Spectators Alike Because of Its Novelty

By Arthur Kennedy

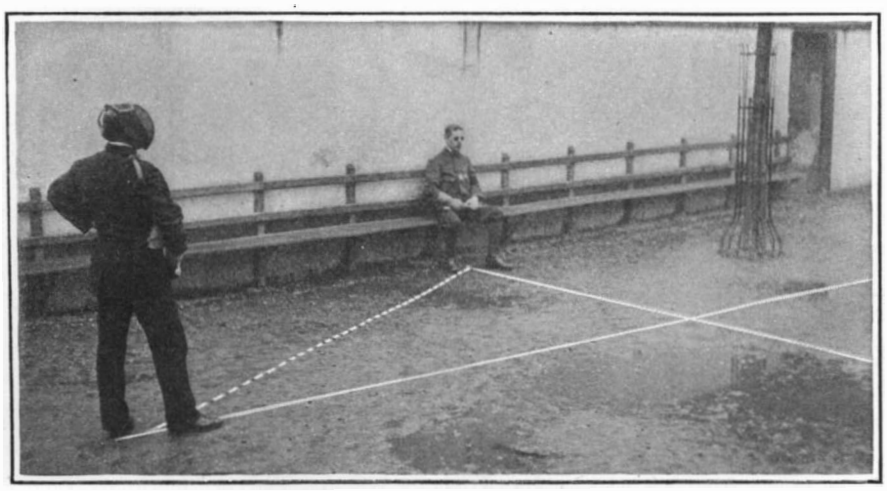
NEVER before has the problem of finding employment for blind men been so vast as at present, when the European war has added tens of thousands to the already large number of such unfortunates. For the greater part the governments of Europe have devoted their energies to finding suitable work for blind men and training them in their new-found tasks. Recently, however, the French have endeavored to create various diversions as well for those whom the war has deprived of their sight, among which is fencing.

To the lay mind it is indeed difficult to conceive how an active sport such as fencing can be indulged in by sightless persons. Yet fencing tournaments in which blind men are the only participants are now common in Paris, and are a source of much enjoyment to both the participants and spectators. At the same time, the sport is of great value as a physical and mental exercise.

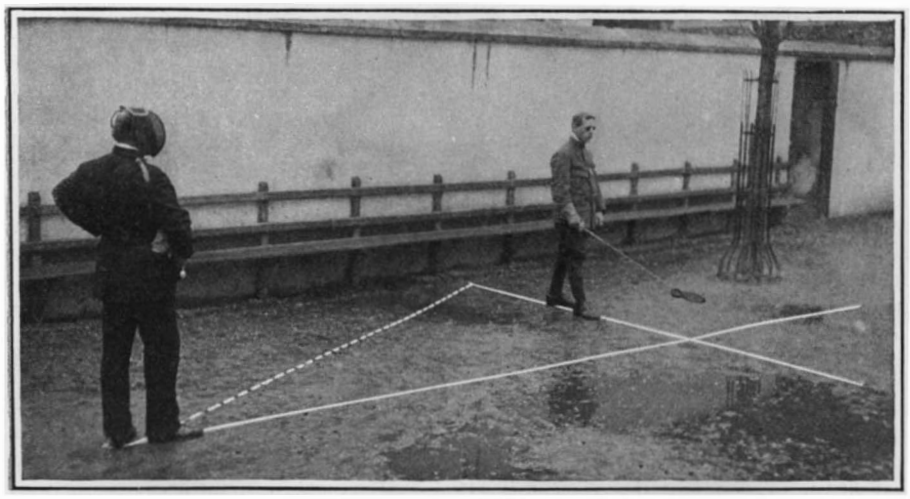
George DuBois, who is at present the blind master of the foils, is the originator of fencing for the sightless. As might naturally be expected, he has had to train his pupils with great patience; for if the teaching of fencing is a matter of much practice and perseverance for those possessing all their faculties, surely it is tenfold more difficult to master by those who have been denied the use of their eyes. In the headpiece, M. DuBois is seen instructing a student in one phase of fencing.

The fencing ground is marked off by two lines at right angles, in the form of steel ribbons. In one of the accompanying views is shown the position of two opponents just before the fencing match: the instructor stands at one end of the steel tape which runs down the center of the courtyard in which the tournaments are held, while the pupil is seated on a wall bench, directly in front of the other line. The line running down the center of the court is known as "the line of the professor," while that intersecting it at right angles is known as "the line of the student." The dotted line represents the path of the sound waves when the professor or instructor calls on the student who, being familiar with the dimensions of the triangle, can approximately gage the distance between the point where his line intersects the "line of the professor" and the instructor. Upon receiving the command, the student stands and walks forward on the line in front of him until he reaches the intersection of the two steel tapes, whereupon he does a half-turn so as to bring him face to face with the instructor standing on the same line. The student salutes his opponent and walks forward on the "line of the professor" until his foil, held straight before him, touches the breast of his opponent, thus indicating that the proper distance separates them. They then cross foils and engage in the fencing contest. Obviously, the blind men engaged in the sport of fencing must rely on their sense of touch almost exclusively, and in this respect the steel tapes resting on the ground are of great assistance to them.

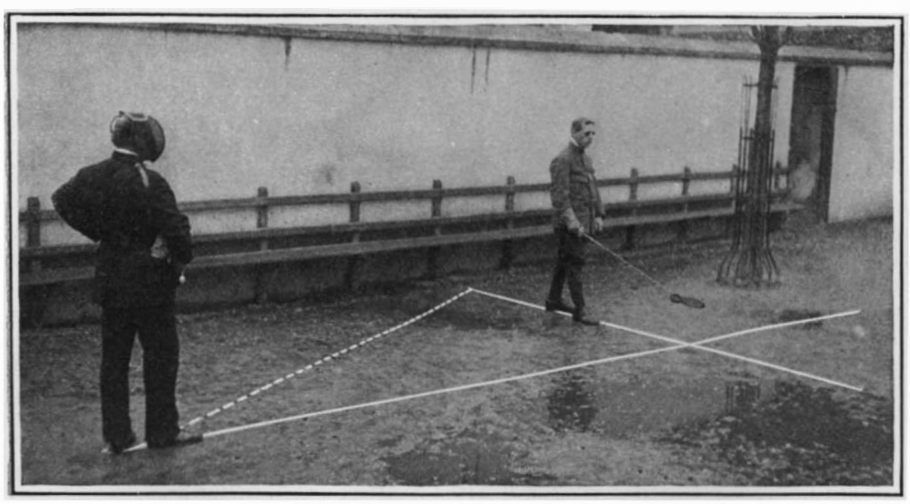
So popular have been the fencing tournaments for blind men in Paris that several schools are now in existence in that city, opened only to students who are totally blind.



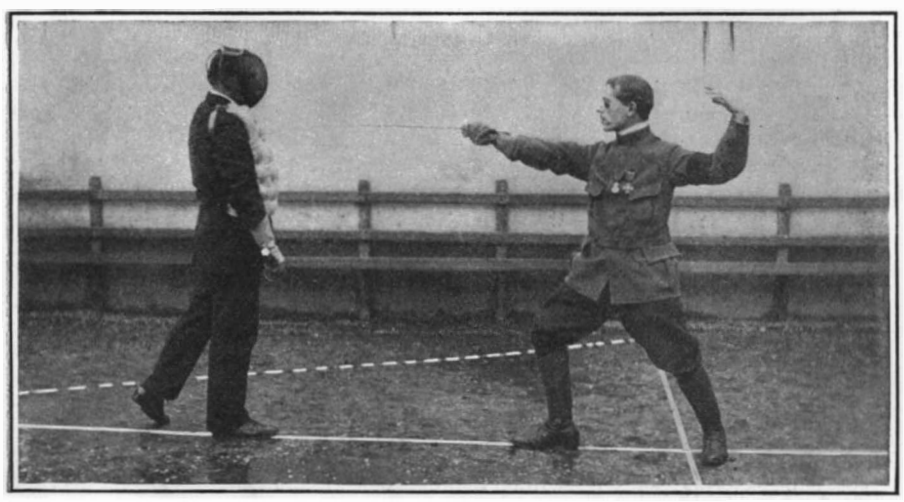
First position in blind fencing: Student seated at the end of his line, awaiting the command of the instructor



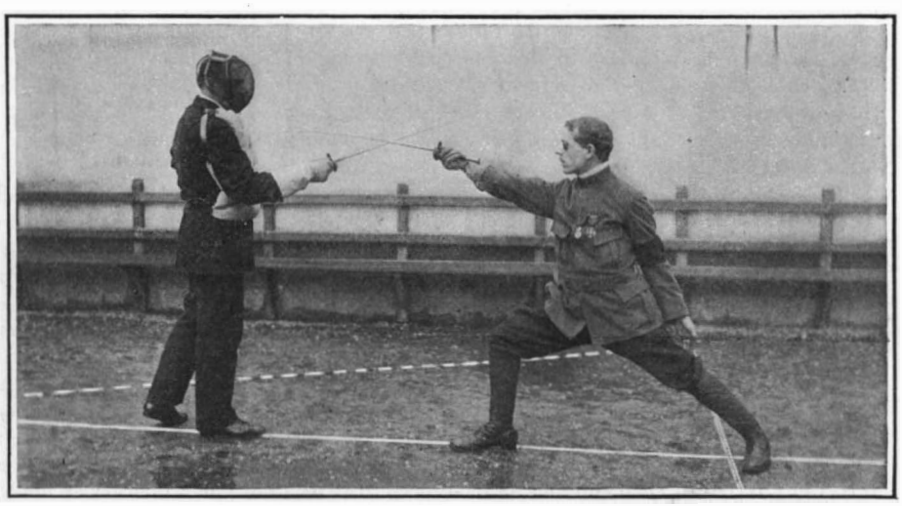
Second position: Student after receiving the command, walking straight ahead on his line



Third Position: After having reached the intersection of the two lines, the student turns and salutes



Fourth position: The student holding his foil straight before him, touches the instructor's breast so as to gage their distance apart



Fifth position: After crossing foils, the instructor and student engage in the actual fencing exercises with a dexterity that is astonishing

New Process for Removing Solder and Tin from Scrap

AMONG the recent patents filed in England is the process for removing the solder, tin and chemicals from scrap and galvanized articles and for utilizing the base metals. The inventor is a South Wales tin-plate worker, who has already secured contracts from several municipalities for treating down refuse such as tin cans, containers and similar metallic waste products.

Formerly large quantities of old tins were taken by Continental dealers practically at the cost of carriage to be utilized in manufacturing cheap articles such as toy soldiers, novelties, mechanical toys and a large assortment of nondescript articles usually found in shops handling inexpensive goods. The usual processes in manufacturing such goods only necessitate a simple cutting or stamping and a light coating of enamel or paint. For the most part, Germany has been the greatest consumer of scrap tin in the past for the manufacture of toys.

Strategic Moves of the War, March 24th, 1916

By Our Military Expert

WHILE general attention has been centered for the last few weeks on the more spectacular activities in the Verdun sector of the theatre of war, events of moment have occurred in the East, where the Russian armies in the Caucasus and in Persia have made consistent progress.

The head of the Russian hammer is swinging through Persia, the general movement being pivoted upon the vicinity of Trebizond, far to the northwest upon the shore of the Black Sea.

News of definite accomplishment comes late, especially from such a distant line. Therefore, while the fall of Kermanshah and Ispahan are reported, comparison of the speed of the Russian advance from previous points with the time elapsed leads to the belief that the columns of advance must now be well beyond their present reported positions, driving steadily toward the Persian gulf and the beleaguered British forces in Mesopotamia. Analysis would indicate that the column from Kermanshah has probably reached the border between Persia and Turkey, through Kirind, where one of the best roads leading toward Bagdad is to be found, thence overland to the border. This should put the Russian forces within about 100 miles of Bagdad, and little farther from Kut-El-Amara, almost directly southward of the present position.

Hamadan was a most important capture, although no considerable feat of arms was required in its taking, for the forces opposing the Russian advance were rather weak and poorly organized. This city is a center from which many usable roads radiate; in all probability, therefore, it has become an advanced base not only for the supply of the main column, which seems to have followed the Bagdad road through Kermanshah, but for the supply of subsidiary columns as well, to either side. The whole Persian movement, in its present phase, commenced at Teheran and Kaswin, extended southwest directly upon Bagdad, and southward toward the Persian gulf, through Kashan and Ispahan, which latter is reported as fallen into Russian hands on March 19th. From Kum, between Teheran and Kashan, a connecting column of advance has proceeded in the direction of Kut-El-Amara, with a probable first objective at Khurramabad, which must be amply covered by Russian lateral thrusts from Kermanshah.

It is all a wild country, and the continuous lines of battle which mark the main eastern and western battle fronts of Europe do not exist. Roads are too few, and sections of the country too forbidding to render supply of such a line possible. The movement, then, consists of a number of columns following the roads and, in some cases, breaking an independent way. Each of these columns, of whose strength and number little is now known in this country, seems to be acting as a separate force, although each column has its definite place in the grand strategic and tactical scheme of the Grand Duke.

To connect up the remainder of the Russian line, the recently captured harbor of Riza, 35 miles from Trebizond, is to be utilized as the base for Russian operations upon the big Turkish city. That there will be serious opposition to this advance is doubtful. Trebizond is not supposed to be a strongly fortified point; and the news that the American consul there has taken over the German consulate rather suggests that no serious resistance is contemplated.

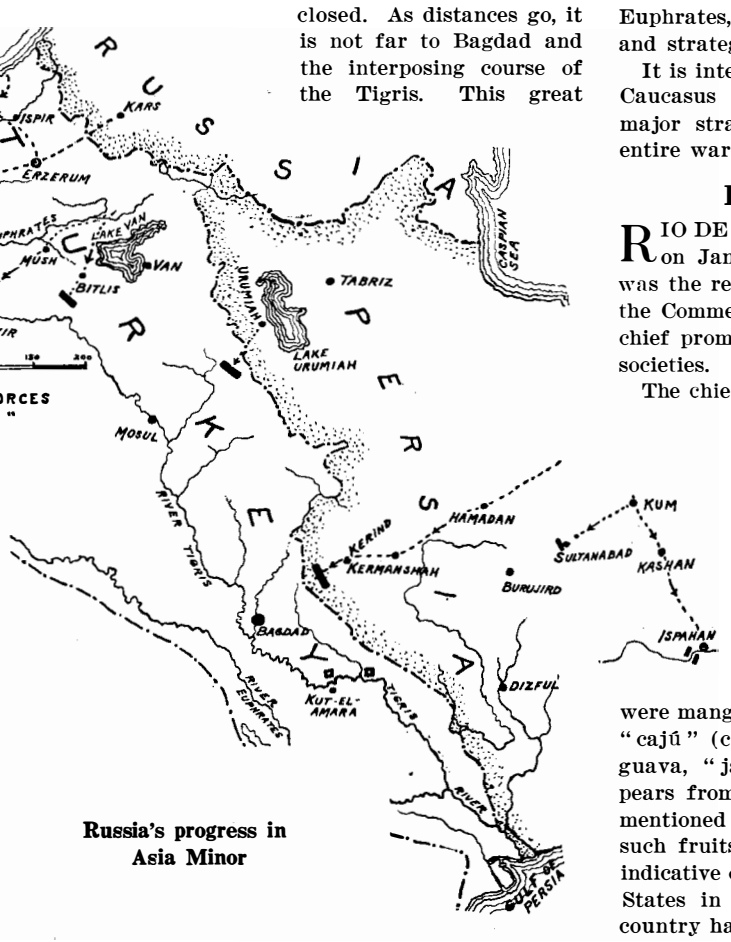
The Erzerum force, which comprehends the most powerful of the Russian forces, has pushed forward to Erzingan, a movement which was indicated in these columns about two months ago as a strong probability, and the city was evacuated without desperate resistance. Erzingan is not really a fortress city, although it is valuable to Russia on account of the concentration of roads upon it. The Turkish forces are reported as retiring upon Sivas, about 150 miles from Erzingan, closely followed by the Russians.

But it should tell another story, the report, when Sivas is reached. This city is directly on the most feasible line for the bottling-up operation which is the objective of the entire Caucasus campaign. This line extends from the Black Sea coast west of Trebizond, through Sivas to the Gulf of Alexandretta on the Mediterranean and as it is the narrowest point across the Turkey-in-Asia peninsula, it will doubtless be defended with desperation. Successful occupation of this peninsula by the Entente forces would sever Turkey's principal territory from the Teutonic alliance, deprive the Kaiser's forces of such supplies as have been drawn from the section, shear Turkey's main possessions from her and definitely lay the spectre of Egypt under the heel of a Teutonic invader. At the present moment, this passageway through Asia Minor represents the only mode of egress and communication with the outside world remaining to Teutonia.

Tremendous efforts have been bent toward completing the Bagdad railway; Germany is not going to passively abandon all this without a struggle, for it is generally admitted that her place in the sun lies here. It is therefore a certainty that when Trebizond falls—as every condition indicates it will ere long—the first step in taking possession of at least a part of this plugging line will have been accomplished; then the Erzerum-Erzingan force of Russian strength must set the next block by laying siege to Sivas and controlling the country intervening between it and the Black Sea.

To complete the line, one must look at the present position of the Russian forces south of Erzerum. The line sways southeast, west of Mush, west of Bitlis, in a broken way controlling the entire Lake Van region. This line continues across the Persian border until it connects with the forces operating in Persia as outlined in the first part of this article.

It is this line which must close the gap if it is to be closed. As distances go, it is not far to Bagdad and the interposing course of the Tigris. This great



Russia's progress in Asia Minor

stream makes a mighty natural barrier of defense that can scarcely be forced over any considerable extent by direct assault; it must be broken wherever possible and the remaining positions on it be turned. The very character of the Armenian country, and Kurdistan as well, supplements the natural defense and the task before the Grand Duke is a difficult one, even in the face of the comparatively loosely organized forces that have so far opposed him.

Beyond the Tigris lies the Euphrates, another barrier. To assist in its turning, Russia, it is reported, has landed troops on the Persian gulf which, in combination with the direct advance are to essay the task. As the Russians approach Sivas, they will undoubtedly attempt to extend their lines southward in constant endeavor to gain ground and draw the stopper closer to the southern end of the gap. It is therefore clearly to be seen that Russia is attempting literally to sweep across Turkey-in-Asia, and brush the debris into the sac between the Black Sea and the Mediterranean.

It is the belief of the writer that one of the most sanguinary battles of the war is coming in this vicinity within the next few months or weeks. Relieved of the necessity for guarding the Dardanelles in heavy force, it seems entirely possible that Turkey can concentrate a million men across the neck of the peninsula, regardless of whatever force Germany and Austria can manage to send to assist them. Every advantage of communication will rest with the Teutonic defenders, except in the vicinity of the Black Sea, which is under Russian control; and the more the line retires toward Constantinople, the more advantage for the defense.

Bulgaria does not dare dispatch troops to aid Turkey; her doors are none too securely locked, for the force at Saloniki is not remaining there, increasing in strength all the time, for a mere junket; Roumania is a constant menace; almost 200,000 Serbs and Montenegrins are being reorganized and equipped near the shores of Greece.

But a million men, with the advantage of interior lines and comparatively short communications, constitute a very strong and dangerous defending force.

It is the opinion of practically every observer that the only hope of full Russian success in this theater of war lies in the exertion of general Entente pressure on all lines. The newly initiated Russian activity in Bukowina and to the northward indicates the beginning of the long heralded Russian offensive, with the secondary motive of swaying irresolute Roumania to active support of the Entente; England and France, if activity is to be effective and ample, must attack also; and Italy cannot be idle.

It may therefore be said that the situation in Turkey is in its second stage; the first, of preparation and initiation, has passed; with splendid strategy and tactics the Grand Duke has done his difficult part, carrying the situation up to the present; the third will obtain when Sivas is reached and when—if—the forces to the southward of Erzerum gain the Tigris and the Euphrates, when Germany's magnificent organization and strategy must be reckoned with on the battle-line.

It is interesting to observe that the operations in the Caucasus and Persia constitute practically the only major strategic and tactical moves combined of the entire war since the battle of the Marne.

First Fruit Exposition in Brazil

RIO DE JANEIRO'S first fruit exposition was opened on January 30th, and closed on February 7th. It was the result of the combined work of the director of the Commercial Museum of that city, who has been the chief promoter, and the officers of several agricultural societies.

The chief object of the Brazilian fruit exposition was to initiate an effort toward bringing the producer closer to the consumer, and thus cut down materially the abnormally high price of fruits in that country, as well as to extend the trade in native products. With but one exception—that of the local representative of a California raisin firm, who presented a line of California dried and canned fruits that attracted much attention—the exhibits were all of Brazilian native fruits. Among the latter were mangoes, grapes, figs, dates, "mamão" (papaya), "cajú" (cashew), lemons, sapoti (sapodilla), bananas, guava, "jaca" (durrian), and peaches, apples, and pears from Southern Brazil. Most of the fruits just mentioned are common in Brazil, but the exhibits of such fruits as peaches, grapes, apples, and pears are indicative of real interest among the Southern Brazilian States in the cultivation of products for which the country has been dependent upon the United States in the past, and still is at present.

The U. S. Bureau of Standards and Engineering Abroad

INCIDENTS in the daily routine of the United States Bureau of Standards point to the constantly increasing recognition that is accorded in all parts of the world to the comprehensive and authoritative nature of the activities of this important branch of the Government service. There are requests for results of investigations, for scientific publications of the Bureau, for information on a seemingly infinite variety of subjects. A single day's record of correspondence received is evidence of the world-wide appreciation of American work upon standardization, and research on problems connected with standards and the determination of the properties of materials.

Inquiries were received from China, Hungary, Australia, New Zealand and Peru during one day recently. The civil engineer in charge of the municipal laboratory for testing building materials at Shanghai asked for the results of the Bureau's investigation of the value of fine grinding of Portland cements by granular analysis. A request was received from the Royal Hungarian Central Office of Weights and Measures at Budapest, Hungary, for an exchange of weights and measures publications between the two governments. The Australian Statesman and Mining Standard of Melbourne desired to purchase two copies of the Bureau's circular on household measurements and also its publication on the metric system. The chief of the electrical laboratory, Peruvian Government's Special School of Engineering, at Lima, asked for a publication containing detailed specifications and materials for constructing standard Weston cadmium cells.

Inking the thumb before making a print

Taking the impression of a finger

Rolling the index finger upon the ink slab

The Origin, Classification and Uses of Finger Prints*

An Ideal System of Identification for the General Public

By Sergeant Frederick Kuhne, Bureau of Criminal Identification, Police Department, City of New York

DURING the last few years numerous articles have appeared in various magazines and newspapers relative to the identification of individuals (principally criminals) by the method known as the "Finger Print System," with no intention of the writers of such articles to convey to the public the information as to the manner in which finger prints are classified and identifications made, nor as to the value of finger prints in cases other than criminal.

When finger prints were first adopted as a means of identification, under a system of classification whereby a print could be filed and readily found, the subject was treated as a science and made to appear technical and difficult. This was done perhaps to keep it confidential for police purposes, no thought having been given to its future possibilities or to the fact that a system, the use of which is indispensable to the Departments of Justice all over the world, would make an ideal system for any institution, department, bureau, firm, corporation, etc., desiring to prove identity or prevent impersonation.

In order to interest the public in this comparatively new system, an endeavor will be made to cover the omissions of previous articles, by explaining the finger print system as concisely as the subject and space will permit by showing that there is nothing difficult or mysterious about the system and how valuable it would be, not only for the police, but for themselves, if everybody had their prints taken and filed for future use.

The only requirements for proficiency in the knowledge of finger prints are ordinary intelligence and practical experience.

Origin

According to the record of researches by prominent criminologists, the individuality of the finger print, or better known as the thumb print, and its value in proving identity was discovered by the Chinese over 200 years B. C., an impression of the thumb being used by them in lieu of their signature in all legal and business transactions; later this method was also adopted in India, and while from time to time various systems for the classification of impressions were advanced, they were not considered until the English government, realizing its value, adopted the "Henry System" in 1901. Since then finger prints under some system have been installed by the police of all the principal cities throughout the world.

A Finger Impression

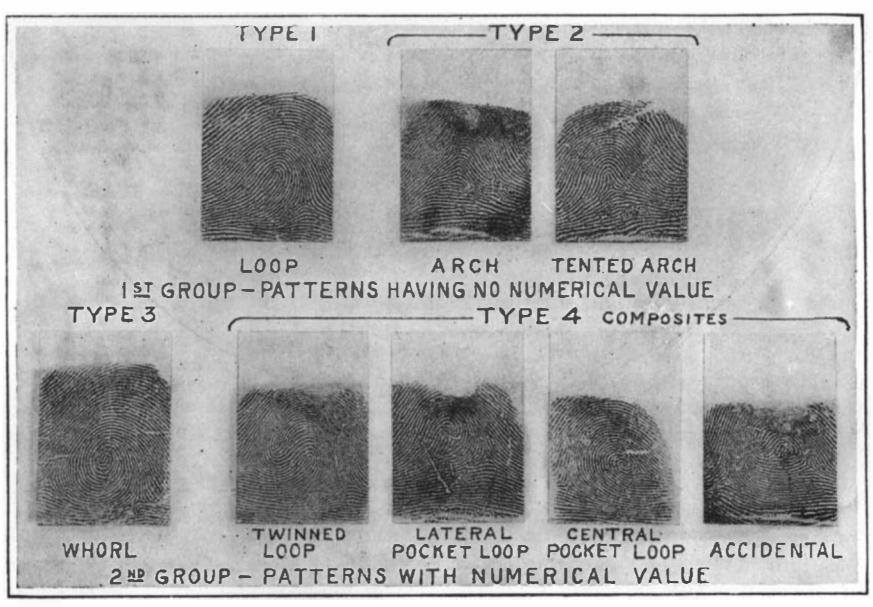
Before entering upon the explanation of classification, I wish to instill into the minds of those not familiar with the finger print work, the real meaning of a finger print or impression.

The dictionary defines the word impression as being the mark, or a mark of anything, such as a stamp, mold, etc.; but as a mark made with the finger is not necessarily an impression and valueless to experts unless it shows the peculiarities of the ridge formation upon which the classifications and identifications are based, it fails to convey the real meaning.

The term finger print or impression, as used by experts, means the reproduction of the ridge formation on the bulb surface of the outer or nail joint of the finger in any manner whatever, whether it be made with ink, blood, or the greasy substance which is emitted by the sweat glands, the outlets of which are situated on the summits of the ridges; whether it be a photographic reproduction or printed by means of what is known as a line cut; or whether impressed in clay, wax, putty, etc. All are impressions within the full meaning and can be used by experts in making identifications. A smudge made with the finger would be a mark but no impression in accordance with the finger print system.

Classification

Although there are various systems for the classification of finger prints, such as the "Conley," the "Flak-Conley" (an improvement on the Conley) and the "French System," the system I am about to explain is the "Henry System," which is the one most universally adopted. Any person who acquires experience enough to be recognized as an expert can create a system of his own, which accounts for the variety of systems.



The "Henry System" of classifying finger prints

All systems are based upon the peculiarities of the ridges, such as their formation into various patterns (by which the primary classification is determined), and by the formation of two fixed points (known as core or inner terminus and delta or outer terminus), together with the ridges intervening and surrounding these two points (by which the sub-classification, and in some cases the final classification, is determined).

All impressions are divisible into one of two groups, of four types and eight distinct patterns, the first group being patterns to which no numerical value is assigned (except as explained later), consisting of two types and three patterns, such as loops, arches and tented arches (tented arches being included under the type of arches), the second group being those patterns to which a numerical value is assigned in accordance with their position in a set of prints and consisting of two types and five patterns, such as whorls, twinned loops, lateral pocket loops, central pocket loops and accidentals, the last four patterns being classed as composite.

A set of finger prints (ten fingers), consisting wholly of patterns to which no numerical value has been assigned (first group), is given a primary classification of 1 over 1, expressed in the form of a fraction, as ½, ¼, ¾, etc,; for impressions consisting wholly or partly of patterns with a numerical value (second group), the primary classification is determined in the following manner:

The ten fingers are divided into five pairs (the first finger of each pair representing the denominator of the fraction and the second of each pair the numerator), the *first pair* being the right thumb and right index finger, with a value of 16 for denominator if appearing in thumb and 16 for numerator in index; *second pair*, the right middle and right ring finger, with a value of 8 for denominator in middle and 8 for numerator in ring finger; *third pair*, the right little finger and left thumb, with a value of 4 for denominator in right little finger and 4 for numerator in right thumb; *fourth pair*, the left index and middle fingers, with a value of 2 for denominator in index and 2 for numerator in middle finger; *fifth pair*, the left ring and left little fingers, with a value of 1 for denominator in ring finger and 1 for numerator in little finger; the value of 1 which, as previously stated, is assigned to prints consisting of patterns having no value, is always added to the result obtained by the addition of the values as assigned to patterns of the second group, so as to account for the 1 which is borrowed for such prints. The following examples will show how the values are applied and the primary classifications determined.

If the right and left thumbs were both patterns of the second group and the other eight fingers of the first group, irrespective as to which pattern, the result would be 16 plus 1, giving 17 for the denominator, and 4 plus 1, giving 5 for the numerator; thus we have the primary classification of 5 over 17 for impressions in which both thumbs are represented either by a whorl, a twinned loop, a lateral pocket loop, a central pocket loop or an accidental; if the right thumb, right ring, right little, left index and left little fingers were represented by patterns of the second group, the primary classification would be 10 over 23. When the ten fingers are considered under the same conditions, the classification is the result in addition of 16, 8, 4, 2, 1 plus 1 for both numerator and denominator, or 32 over 32. By this arrangement of values we have the square of 32 or 1,024 primary classifications, running from 1 to 32 over 1; 1 to 32 over 2; 1 to 32 over 3, and so on, up to 1 to 32 over 32.

The primary classifications are further subdivided by the use of letters, as A for arch, T for tented arch, R for radial loop, U for ulnar loop, for patterns of the first group in the index fingers and I for inner, M for meet, O for outer, determined by tracing the ridges of patterns of the second group; but as this part of the system is very lengthy, I will not attempt to explain it in detail owing to limited space.

Prints with a loop appearing in the right little finger would have what is termed a final count or classification in the form of a numeral representing the number

(*Concluded on page* 365)

* Finger Print Instructor, by Frederick Kuhne. Munn & Co., Inc., Publishers.

The Heavens in April, 1916

Remarkable Surface Features of the Planet Mars

By Prof. Henry Norris Russell, Ph.D.

WHILE Mars is still conspicuous in the evening sky, we may well continue the discussion of the planet's remarkable surface features. Reasons were given last month for believing that the great differences between the drawings of the planet by different observers arise from what is technically called "personal equation"—that is, from differences in their visual and mental perceptive apparatus, operating unconsciously; and that, while a multiple of faint and difficult details undoubtedly exist on the planet's surface, the only way of deciding which of the various types of drawings are probably most like the reality is by means of test observations on "artificial planets," which have never yet been made with sufficient comprehensiveness to answer the question.

We may now consider the principal explanations which have been suggested for the observed details, or, rather, for the changes to which they are subject, for the mere existence of permanent markings of various shapes, sizes and colors on Mars would be no more surprising than on the Moon's surface or anywhere else.

The most conspicuous of all the changes—those of the polar caps—are the easiest to understand. From the way in which they shrink in spring and summer, and reappear again in late autumn, it seems practically certain that they must be deposits of snow or frost of some kind—deposited on the surface as the winter's cold approaches and melting away or evaporating as the warmth returns.

Since the material which disappears from one cap evidently goes, in part at least, to form the other, the planet must have an atmosphere, through which the vapor of the material forming the caps is carried from pole to pole. The existence of an atmosphere is confirmed by several other lines of observation, notably by measures which show that there is a certain amount of twilight on Mars after the sun has set, just as there is on the Earth.

The composition of the atmosphere and of the polar caps is harder to find out, and the existing data are puzzling. The most obvious suggestion is that the white stuff at the poles is actual snow, or hoar frost—frozen water, in some of its familiar forms. The only difficulty about this view is that, so far as can be determined from existing data, it is very hard to see how the surface of Mars can get hot enough, even in summer, to melt snow—or even reach the temperature, perhaps not far above zero Fahrenheit, at which snow begins to evaporate slowly into perfectly dry air, just as camphor does in a warm room.

An alternative idea is that the caps consist of "carbon dioxide snow"—the white flocculent solid into which this gas condenses at a temperature of about 80 degrees Centigrade, or 112 degrees below zero Fahrenheit. But here the difficulty is the other way, for it is equally hard, or harder, to see how the surface of the planet can be cold enough to permit the existence of solid carbon dioxide through the summer, or to allow it to form again as early in the Martian autumn as the white deposit actually does.

In the opinion of the present writer, after a careful examination of the data, the question must be left unsolved for the present.

Only one thing seems certain: the polar caps must be very thin, for they sometimes disappear completely in summer. Now the whole amount of heat received during a Martian summer would suffice to melt and evaporate a layer of snow (or of solid carbon dioxide, for that matter) only a few feet in thickness. Since most of the heat actually received must be lost again by reflection or radiation into space, the thickness of the polar caps must be very small, probably averaging only a foot or so.

All the evidence goes to show that the planet's atmosphere, also, is far less extensive than the earth's. It is hardly safe to make a numerical estimate, but the assumption that there is one tenth as much atmosphere above a square mile of the surface of Mars as above an equal area on earth seems a rather liberal one. Regarding the composition of this atmosphere, there are indications, from certain difficult and delicate spectroscopic measures, of the presence of water vapor and oxygen; but other measures by fully as trustworthy methods show no perceptible signs of them. And the quantity present must at most be very small.

We may now take up the most interesting problem—the nature of the dark areas and of the "canals." The former are certainly not seas, as was once supposed—a sufficient proof being that the brilliant reflection of the sun from the surface of the water, which in that case would be conspicuous, has never been observed.

A widely held opinion—and one which is entirely plausible, if the planet's temperature gets above the freezing point of water, and the polar caps are composed of ordinary snow—is that these dark areas are regions of vegetation scattered over the otherwise desert surface of the planet.

The enlargement and darkening of these areas in the local summer, when the moisture from the melting polar snows reaches them (whether by streams, rain or dew) is just what might be expected, while their shrinkage in autumn and winter (when the air becomes very dry again) and the change of color in some places from green to brown, are equally easy to explain.

This is a very attractive theory, but is by no means the only one which can explain the observed changes. For example, Arrhenius, guided by the behavior of certain desert regions in Persia and elsewhere, has suggested that the dark areas may be alkali flats, where the sand is full of hygroscopic salts. Whenever there is much moisture in the atmosphere, these salts will absorb it from the air, and form a brine which will moisten the sand and make it look dark; but when the atmosphere becomes very dry (all the available water being locked up in the growing polar cap) the water will evaporate again, and the dissolved salts will effloresce, leaving the dry surface covered with a whitish or yellowish deposit.

Other explanations, not involving the presence of life, could doubtless be devised; and in all probability some of these chemical explanations could be adapted to the hypotheses that the substance whose vapor diffused from the polar caps into the atmosphere was not water, but something else of lower melting point.

On the vegetation theory, the canals are explained as fertile strips of land bounding watercourses which cross the deserts. This does not prove them to be artificial; for, as Professor W. A. Pickering, the originator of this idea, has pointed out, the valley of the Nile, seen from the moon, would appear as a green streak crossing the great yellow area of the African desert.

As in this terrestrial case, the watered region may be many times wider than the watercourse itself.

The progressive darkening of the canals after the polar cap shrinks, beginning nearest it and extending gradually outward to the equator and beyond it, can then be explained as the result of the progress down them of floods of water from the melting snow, and the subsequent growth of vegetation—as happens, indeed, in the case of the Nile.

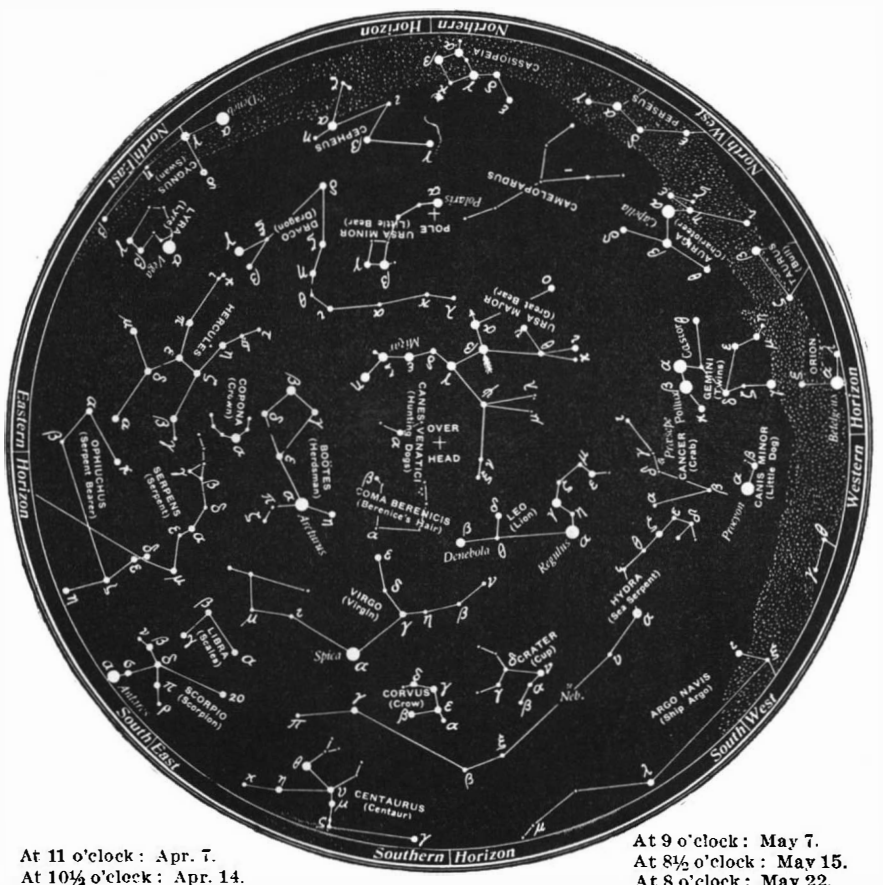
Dr. Lowell, starting with this explanation, argues further that the canals form so remarkable a geometric network of fine, sharp straight lines that they cannot have arisen from the casual operation of natural forces, but must be artificial, and the products of great engineering skill. He reasons also that, since the water flows away from the polar cap in all directions along different canals at about the same rate, and goes a long way beyond the equator (as indicated by the darkening of the canals), while six months later, by the Martian calendar, it flows along these same equatorial canals in the opposite direction, it cannot flow under the mere force of gravity, but must be artificially conducted, in a word, *pumped*—which shows that the designers of the canals have not become extinct, but are still using them for irrigation.

To develop arguments which show that it would be possible to get evidence of the existence of intelligent inhabitants upon a planet fifty millions of miles away is an admirable piece of constructive reasoning. There is moreover, nothing in our present conclusively established knowledge of Mars which is irreconcilable with Dr. Lowell's theory; but it should nevertheless be borne in mind that some of the most important bases upon which it is established are not to be counted as conclusively settled by observation, and that it is in any case not the only possible explanation of the phenomena.

It has already been shown that the exact geometrical character of the canal system is very far from being proven, and with this, the argument for the artificial character of the system loses its cogency. Again, and more fundamentally, it is not certainly established that vegetation exists on Mars, or even that the polar caps are of frozen water, and that it ever gets hot enough to melt them.

If they do supply the planet with water, the alkali-mud theory will account for changes in the color and visibility of canals as well as of larger areas, and, as Law has suggested, the progressive appearance, first of the canals nearest the pole and then of those farther away, may be explained without invoking intelligent action by assuming that, as the polar caps melt a thin haze spreads over the surface, concealing the full details, which finally clears, starting at the pole, so that the canals, which have all darkened, invisibly to us, under the hazy covering, come into view successively, as reported by the observers.

When all these possibilities are considered, the writer, for his part, is loath to make dogmatic statements concerning Martian problems. The explanations here very briefly outlined have been suggested to their advocates very largely by analogy with features of the Earth's surface. If we could be equally familiar with the conditions prevailing on other bodies, we might well be led to still different, and equally possible, theories concerning Mars, and find ourselves more embarrassed than ever to choose between them, until more distinctive observational data became available.



At 11 o'clock: Apr. 7.
At 10½ o'clock: Apr. 14.
At 10 o'clock: Apr. 22.

At 9 o'clock: May 7.
At 8½ o'clock: May 15.
At 8 o'clock: May 22.

At 9½ o'clock: April 30.

NIGHT SKY: APRIL AND MAY

The Heavens

The appearance of the sky in the latter part of an April evening is shown in our map. Almost overhead, but a little to the north, is the Great Bear. The "Pointers" in the bowl of the Dipper point downward to the Pole-Star, and beyond it to the zigzag line of Cassiopeia, low on the horizon. To the right of these, in the northeast, is Draco, coiled about the Little Bear. Low in the northeast is the bright star Vega. Above this are the quadrilateral in Hercules, the semicircle of Corona, and the resplendent Arcturus. Virgo is well up in the south. Its brightest star, Spica, makes a fine triangle with Arcturus and Denebola in Leo.

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Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

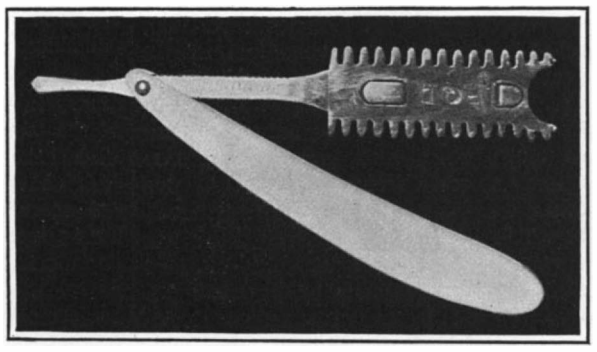
Surgical Scalpels with Detachable Blades

FOR the past three or four years, or ever since Dr. Murphy, of Chicago, conceived the idea of attaching a safety razor blade to a scalpel handle for an operating knife, there has been considerable discussion among the surgical profession relative to a scalpel provided with a thin, wafer-like blade similar to those used in safety razors.

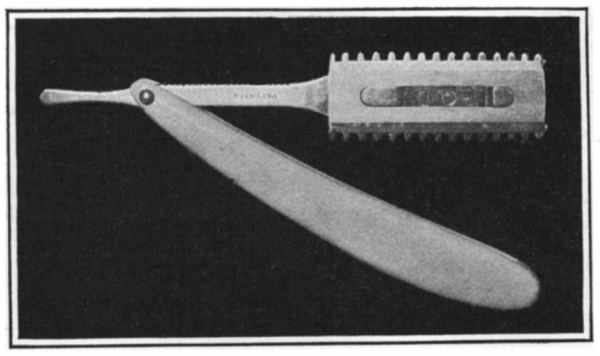
While the exceedingly sharp edge of the razor blade recommended it for surgical purposes, since the healing of a wound from a keen knife is more satisfactory than that from a dull knife, still, its shape was not satisfactory; the square corners and straight cutting edge making the manipulation of such improvised scalpels most inconvenient. This obvious disadvantage was overcome in a number of inventions subsequently developed, providing surgical scalpels with detachable blades of the proper shape, or rather, better shaped for the purpose. For certain reasons, however, these new instruments did not seem to find great favor with the surgical practitioners; perhaps the main reason was that in addition to the handle and blades, other parts were used in their construction, creating crevices and joints, all of which made the article either impossible to sterilize without taking it apart or difficult to maintain antiseptic. Hence these scalpels were limited in their uses owing to inherent imperfections, in spite of the obvious advantages of the principle employed.

There has recently been invented a form of scalpel with detachable blades, which appears to solve the problem in a most practical manner. Not only are the blades of the proper shape, but they are so made as to be readily placed on the scalpel handle and firmly held thereon without the use of a clamping device. In fact, the construction of the new scalpel is no more complicated than the ordinary instrument.

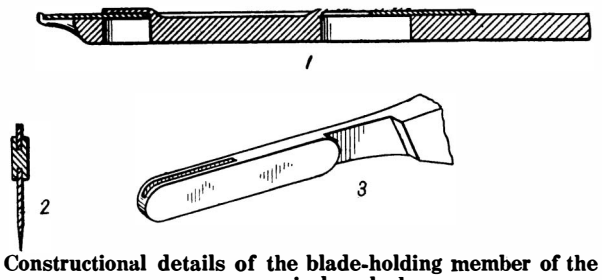
The inventor of the new scalpel, Morgan Parker, of Newport, R. I., has made use of the spring flexibility of thin steel blades in an ingenious manner for holding them on the handle. The device makes use of the spring characteristic as the stage through which the blade must pass in order to gain its position on the handle. This is accomplished by automatically causing the bending of the blade while attaching, which again snaps straight when in position, making it immovable from the handle until again sprung, resulting in the elimination of all moving and accessory parts and reducing the instrument to a handle and the blades. Thus the blades are made to slide onto the handle and snap into place, and are as readily removed in the reverse order, by a simple manipulation of the fingers. The construction of the new scalpel is such that a blade cannot be dislodged except when so intended by its user; and when in position on the handle, it is held rigidly in order that it may not be over-flexible while in use.



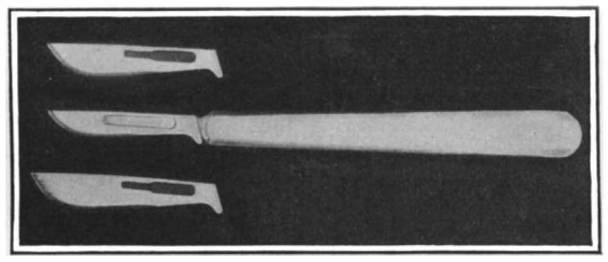
Recently invented safety razor with the blade removed, showing the lugs



New type of safety razor with the renewable blade held in position



Constructional details of the blade-holding member of the new surgical scalpel



Surgical scalpel of simple design and its renewable blades

With the new scalpel, fresh blades are available for each operation, insuring a sharp and perfect edge. Furthermore, the time and trouble incidental to the resharpening of the regular scalpel blades are eliminated, for the cost of the blades is low. The instrument lends itself to sterilizing just as readily as the conventional scalpel.

Mr. Parker has also perfected a type of safety razor made along the same general lines as the usual razor but provided with a guard and renewable blades. Here again the flexibility of the blades has been made use of. A long slot is cut in each blade, serving to hold this member on the back of the guard by engaging with two ears of different lengths. To insert a new blade in place, it is slightly bent while engaging with the first or long ear, but snaps back into shape when pushed far enough and is then shifted so as to engage with the second or short ear, resulting in its being held firmly in place. The reverse operation is followed to remove the blade.

Although the razor just described is of the utmost simplicity, comprising but three parts—the handle, the guard which is provided with the holding ears as integral parts, and the renewable blade—still it has practically every desirable feature possessed by other safety razors: it is inexpensive, readily cleaned and efficient.

Carbide Candle Instead of Kerosene in Oil Lamps

DUE to the European war, there have been very few practical novelties developed during the past year, and such novelties as have appeared have had some connection with the war in nearly every instance. This is the case with the German carbide candle device, shown in the accompanying illustration.

The new carbide candle is made in two sizes, for 10- and 14-inch burners, and can be applied to any lamp after the removal of the kerosene burner, by means of the movable socket. Thus there is furnished a new sort of lamp which provides a cheap means of illumination where kerosene is lacking.

Converting an ordinary kerosene oil lamp into a gas lamp, using the carbide candle

The operation of the carbide candle is simple. After the removal of the bottom cover, the candle is filled with about 75 grams of carbide and the cover replaced. The kerosene container of the lamp on which the candle is to be used is then half-filled with water. The candle is placed in the font of the lamp and at the end of about a minute a constant supply of acetylene gas issues from the burner. It is advised that the candle be placed in a glass tumbler first before placing it in the font of a lamp, in order to make sure that no gas escapes from the screwed-on bottom. After being thus charged and prepared, the candle can be used for a considerable period of time, until the carbide is exhausted.

When too much water is absorbed into the carbide candle, the flame becomes too large. Conversely, the flame will be too small when the carbide tends to form mud or slime at the bottom. These conditions, however, are soon regulated, and after a brief use can be avoided without trouble. Obviously, the duration of one charge depends upon the size of the candle. The carbide used costs on the average about one pfennig per hour in Germany, where the device has been invented and widely introduced since the beginning of the war. When the carbide is exhausted in the candle, there remains a chalk-like residue in the holder, which is easily loosened when dry by a spoon-handle or other utensil. If it is necessary to refill hastily, the residue may be removed while still moist; but since in this case gas may still be forming, great care must be exercised not to come too near another light.

Use of Periscope for Purposes Other Than in Warfare

MUCH has been said of the extensive use of periscopes both by submarines running below the surface of the water and by soldiers in the trenches. However, the periscope has heretofore figured but little in the peaceful walks of life.

Recently, a large crowd gathered outside the War Office in London for the purpose of seeing Lord Kitchener just before he started for the front. One man, fearing that he would be unable to secure a glimpse of the famous British general, brought with him a periscope of the variety used by the British soldiers in the trenches in Flanders. Needless to state, this optical device enabled him to secure a field of vision over the heads of the people surrounding him.

Using a periscope in a crowd in order to get a glimpse of General Kitchener

Preparedness for Peace in the Mineral Industries

(*Concluded from page* 351)

The Bureau of Mines is experimenting with new methods by which it is believed this loss can be reduced to 10 or 15 per cent.

The uses of bismuth are growing, and if the metal could be obtained more cheaply, these uses would be greatly increased. Probably 4,000 pounds of this material is going daily out of the stacks of the smelters in the western states.

Many of the rarer metals have a great importance in their relations to the industries of the country and to human comfort. A very important group of the steel-alloying metals includes chromium, cobalt, nickel, tungsten, vanadium, molybdenum, and titanium. By the use of these wonderful alloy steels, largely developed in the United States, one man now does as much work with metal-cutting machinery as could formerly be done by five men. Tungsten, besides its use in steel, in which it is saving millions of dollars a year in wages, is saving other millions of dollars to consumers of electric light. Incandescent lights with tungsten filaments furnish for 15 cents as much electric light as one could get ten years ago for one dollar, and of much better quality. There still are opportunities in the metallurgy of tungsten.

Uranium is chiefly notable from its being the parent of that wonderful element, radium. The Bureau of Mines, in connection with the National Radium Institute, has manufactured radium on a commercial scale from the carnotite ores of Colorado at a cost one third the price asked by foreign producers. This triumph of American skill and invention is not only making this country independent of foreign sources of supply, but is enabling American physicians to apply to the cure of cancer radium in quantities not available to physicians in Europe.

Practically all the potash salts used in the United States have come from Germany, the imports amounting to $15,000,000 annually. To remedy this situation, the Government has been actively engaged in investigating, as possible sources of potassium salt, saline residues, natural and artificial bitterns, alunite and similar minerals, the igneous rocks and minerals like the potash-bearing feldspars, the greensand marls, and organic sources such as seaweed, molasses residue, wool scourings, etc. Experiments indicate that the United States may soon be relieved of absolute dependence on foreign resources of potash salts.

The waste in mining phosphate rock is large, in the Florida pebble field being probably two or three times the tonnage of rock saved. Among the possibilities of the future are the introduction of chemical methods whereby low-grade deposits can be converted into concentrated forms and shipped at a profit, the direct application of low-grade phosphate rock to the land, and the utilization of other sources of phosphate, for example, the mineral apatite and phosphate-bearing slags, large quantities of the latter now being wasted.

We are entirely dependent on Chile for our natural nitrates, the imports from that country in normal times amounting to about $20,000,000 annually. Nitrates are being made from the nitrogen of the air by electrolytic processes on a small scale in the United States, and successfully on a large scale in Norway. Our wastes of nitrogen, in normal times worth in combined form about 15 cents per pound, are almost inconceivable. Although we coked in a recent year over 63,000,000 tons of bituminous coal, we recovered only $3,800,000 worth of the $22,000,000 worth of recoverable nitrogen contained in the coal. This we can charge to the wasteful beehive coke-oven.

Through the inventive genius of an American, Herman Frasch, the United States occupies the dominating position in the sulphur industry of the world. Methods are now extensively employed in the manufacture of sulphuric acid from smelter gases, the production of acid in this way in 1914 amounting to 951,000 tons, the remarkable growth of a profitable industry from what was a nuisance and a waste product. Pyrite, the mineral used primarily in making sulfuric acid, is a by-product in coal mining in several states. Formerly it was discarded, but in 1914 31,500 tons, valued at $84,000, were produced in three states.

One of the largest of our imports is pottery, the import value of which in a recent year amounted to more than $11,000,000. There is little doubt that a careful study of our own deposits and methods of preparation would enable us to utilize domestic material more extensively. Investigations by the Bureau of Mines indicate that an immense tonnage of the purest known semikaolinized feldspars is available in the southern Appalachian region.

The growth of the Portland cement industry in the United States has been one of the wonders of modern industry. In 1880 there were produced in the country 85,000 barrels; in 1913 more than 92,000,000 barrels, valued at as many dollars. There seem to be excellent reasons for stimulating the export trade to South America. Although this exporting may not promise large direct profits, the creation of such a trade should benefit the industry through the opportunity to dispose of surplus stocks. A serious loss at cement plants is in the flue dust, ranging from 4 to 10 per cent of the raw material. A plant at Riverside, California, has installed the Cottrell process for catching its dust, which was injuring surrounding orchards, and has found that great quantities of potash had been going to waste, the value of which, now recovered, is nearly as large as that of the cement produced.

The United States produces more than two thirds of the fuller's earth it consumes, and when it is considered that prior to 1895 there was no regular production, the progress of the industry has been remarkable. Many samples of American earth are distinctly superior in bleaching power to the English earth, and the investigations of the Bureau of Mines show the domestic earth to be better suited for refining edible oils than the imported product.

Bromine, produced in West Virginia and Ohio, is largely shipped abroad and returned to the United States in the shape of fine chemicals, for which we pay the costs. The large quantities of calcium chloride formerly wasted in the manufacture of soda are now being used in part, and it is hoped that new uses for that which is now wasted will soon be found.

Comparatively little is known about a large number of the rarer elements, especially tantalum, columbium, thallium, thorium, beryllium, and the twenty or more elements of the cerium and yttrium earths. No one can say what an exploitation of this field might lead to, but it is through scientific investigation of such problems that many industries have been developed, perhaps the most noteworthy being that of the Welsbach gaslight mantle. There is reason to believe that a more general manufacture of thorium nitrate, the important chemical product necessary for the manufacture of incandescent mantles, may be developed in this country. There are deposits of monazite in many states, and with the knowledge that a valuable material—mesothorium—can be made as a by-product, the industry should pay well. Mesothorium is used successfully in therapy in the same manner as radium.

From our copper refineries and sulfuric acid plants at least 300,000 pounds of selenium is going to waste each year. Selenium is the only known element having an electrical conductivity that varies with exposure to light, and this property will undoubtedly give the metal special prominence in future. Tellurium is also going to waste in quantities. No present use of importance is known for the element, although it is obtainable at a low price. Silicon, next to oxygen, is the most abundant of all elements, and until recently has been obtained only as a chemical curiosity. It has remarkable powers of resistance to all ordinary weathering agencies, wonderful properties of resistance to chemical agents, is easily made,

and except for its brittleness would probably find extensive use.

The United States has an ample supply of crude barytes, the mineral used in the manufacture of white paint, rubber, artificial ivory, fireworks, etc. Yet because of imperfect methods of mining and treatment of American ores, we have depended on Europe for this material. Since the war began, however, barytes compounds are being manufactured in several states. The new industry is not only meeting the domestic demand, but is also furnishing large quantities for export.

As a consequence of "strain breaks," resulting from rock stresses, heavy losses have been entailed in marble quarries. The Bureau of Mines has lately devised a method of relieving the rock pressure so as to prevent destructive fracturing, and great masses of valuable marble that would otherwise be wasted are now being utilized.

Large areas of peat of considerable value lie near great iron mines in northern Monnesota, which are now being worked entirely with coal brought from a thousand miles away. This peat could be used to replace the coal for generating producer-gas or steam in large power plants in such a way that the by-product of ammonia recovered should pay the entire cost of plant operation, and thus the producer-gas, an excellent fuel for engines, be obtained free of cost.

The Heavens in April, 1916

(*Concluded from page* 358)

Hydra, Crater and Corvus are visible in the southwest, and Gemini, Canis Minor and Auriga in the west and northwest.

The Planets

Mercury is in conjunction with the sun on the 14th—behind it—and is practically invisible, except at the very end of the month, when he sets about an hour and a half after the sun. He is then in Aries, not near any bright star, and should be easily identifiable in the twilight.

Venus is evening star in Taurus and is exceptionally bright and conspicuous.

She reaches her greatest elongation (or apparent distance from the sun: 45° 39′) on the 24th, and is at the same time in a very high northern declination — nearly 27°. The combination of these two things keeps her in sight until 10:45 P.M., while early in the evening she is more than 30° above the horizon. At the same time she is nearly, though not quite, at her greatest brilliancy, being 100 times as bright as a standard first magnitude star. She is so bright that she casts a shadow, which may very easily be seen by going into a room into which no artificial lights, such as street lamps, can shine and letting the light of the planet come through a western window and fall on the opposite wall.

Mars is in Cancer, but has reversed his motion, and is swinging back into Leo at an ever-increasing rate. He is 85 million miles distant at the beginning of the month, and 108 million at its close, and is growing smaller in the telescope, and fainter to the eye; but he still looks brighter than a first-magnitude star.

Jupiter is in conjunction with the sun on the 1st, and can be seen only at the end of the month, just before sunrise. Saturn is an evening star in Gemini, remaining in sight till about midnight.

Uranus is a morning star in Capricornus, and Neptune an evening star in Gemini.

The moon is new at 11 A.M. on the 2d, in her first quarter at 10 A.M. on the 10th, full at midnight on the 17th, and in her last quarter at 6 P.M. on the 24th. She is nearest us on the 20th, and farthest off on the 9th. During the month she is in conjunction with Mercury on the 1st, Jupiter on the 2d, Venus on the 6th, Saturn on the 9th, Neptune on the 11th, Mars on the 12th, Uranus on the 25th, and Jupiter again on the 30th.

Neuimin's Comet

A faint comet was discovered photographically by Neuimin, at Simeis, Russia, on February 24th—just after the last of these articles was completed.

It was then in the southern part of

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War Game—III

(*Concluded from page* 353)

Answers to Questions in War Game 11.

Question 1. The situation of the Advance Guard is indicated on accompanying map.

Question 2. The outpost line, with supports and reserve, is shown on map. The reason for selecting this line for the outpost is, first of all, the fact that the most likely approaches from the north are secured against the advance of enemy forces, thus giving full protection for the main body.

Especially during the night is it a very hazardous task for any force to leave the roads, therefore, the occupancy of the approaching roads must be given first consideration. The outguards not located on roads form a protection against possible smaller harassing enemy parties, and, in this open country, make it almost impossible to disturb the rest of the camp.

The assigned outpost line is an ideally good line for this service. The section covered by A Company is an almost perfectly clear country with good supporting points, while B Company has an even more advantageous section on account of the natural barrier formed by the Conestoga Creek.

By sending out patrols as indicated by arrows, the security will be further improved.

Questions 3 and 4. See map for answer.

Question 5. The commander of B Company gives the following order:

"Considerable enemy forces have been reported 14 miles north, near *coal mines.* Our detachment will camp for the night in *Norrisville.* Our battalion will establish outpost on line *Clan Road* to *Bowers Bridge.* In case of attack this line will be held.

"This company as Support No. 2 will guard the section from the western slope of *Goat Hill* to *Bowers Bridge.*

"Five outguards will be sent out and one special patrol.

"Sergeant S/1, with one squad, on slope of *Goat Hill* between bridge and hilltop.

"Sergeant S/2, with two squads, on *Conestoga Bridge* on road.

"Lieutenant L, with two squads, on railroad bridge.

"Corporal C/1, one squad between railroad and *Bowers Bridge.*

"Patrols to be sent out by outguards Nos. 2, 3 and 5.

"One special patrol to Deansville.

"Communication to be maintained from right to left. Third and fourth platoons remain here as support.

"Reports to be sent here."

Occurrences of Importance.

At 7:35 A.M., the independent cavalry, Captain C, in order to delay the enemy, blew up railroad bridge spanning Timcum Cancer, and moved slowly southeastward into Hydra.

Two orbits have so far been computed, one by Castro at Santiago, Chili, the other by students of the University of California. They agree in showing that the comet came to perihelion early in March, and that it is moving in an orbit but little inclined to the ecliptic (one computer finding 10° and the other 17°) and in the same direction as the earth.

The perihelion distance is 1.58 times the earth's distance from the sun, according to the first set of elements, which were computed on the usual assumption of a parabolic orbit. The California computers find that the orbit is elliptic, with a perihelion distance of 1.33, and the short period of 5.2 years, but describe the computed value as still uncertain, owing to the short time available for observation.

According to the ephemeris based on the latter elements, the comet on April 1st should be in about 9 h. 26 m. R. A. and 2° declination—that is, about 6° north of Alpha Hydrae—and moving southeast about half a degree per day. It is receding from the sun and growing fainter, and will probably be visible only in large telescopes.

PRINCETON UNIVERSITY OBSERVATORY.
1916, March 20.

Creek and, taking a position southwest from this bridge, partially sheltered by trees, opened fire upon the advance guard of the enemy.

The main body of the enemy immediately changed direction in order to gain other bridges, while their advance guard deployed and occupied stretch between railroad and Nehaminy River.

At 8:50 A.M., enemy artillery opened fire from Chester Hill with two guns, upon squadron.

At 9:30, Captain C retired from his position to nearest edge of Pine Forest.

At the same time, our own artillery, from Lookout Hill, responded to enemy's fire.

* * * * *

The Fourth War Game will deal with the combat between these two detachments, first showing our own, then the enemy's action.

The Origin, Classification and Uses of Finger Prints

(*Concluded from page 357*)

of ridges in such loop between the two terminal points (core and delta), these two points being excluded from the count.

Making Identifications

After the primary classification, subclassification and final classification (if any) of a print have been determined, they are compared with the prints on file having the same classification, by taking into consideration all the peculiar formations of the ridges and patterns in the print; if they do not agree in the minutest detail they are not of the same person.

As an experiment, take your own print by using an ink pad instead of printers' ink, and examine it under a magnifying glass and you will see the numerous characteristics of the ridges, such as a single ridge separating into two ridges, termed ridge bifurcation; ridges that end abruptly, short ridge lines or dots, etc.; upon these points the identifications are based, they being exactly alike in duplicate prints, even though taken years apart.

How Used

Although finger prints are utilized with success in the Army and Navy Departments of the United States for the apprehension of deserters and to prevent the burial of soldiers as unknown in case of war and by a few savings banks for the protection of depositors who are unable to write, thereby preventing the withdrawal of funds by unauthorized persons, its greatest success perhaps has been in the Police Departments, where positive identifications are being made daily, whether the person be alive or dead (good impressions of the dead being obtainable until decomposition sets in), irrespective of name, age, sex, color or nationality.

It also aids them in apprehending and identifying criminals who unconsciously leave their impression or impressions on some article at the scene of a crime, these impressions very often being submitted as the only evidence of guilt.

When impressions of three or four fingers are unconsciously left, a classification is possible by considering each of the missing fingers under both groups of patterns; but where the impression is of one finger only this is not possible, as no system has been devised for its classification, nor do we know of a method to determine which one of the ten fingers it might be. When identifications are made of one impression, it is usually done in one of two ways; either by comparing the print with those on file of persons suspected of the crime, or by the arrest of some person charged with the crime, in which case the finger prints are taken and a comparison made. If no identification should be made at the time under either of the preceding circumstances, the impression is preserved for future use.

How Finger Prints Could Be Used

As previously stated, the Police Departments make positive identifications of the dead as well as the living, but unfortunately at the present time such identifi-

cations are only possible where the deceased person has been previously finger-printed for some crime or violation for which finger prints are authorized by law.

What a valuable file the police could control if the public would only realize the latitude of finger print possibilities and the benefits to be derived therefrom not only by themselves, but their families and relatives, if the police were equipped (by reason of having their prints) to identify all persons coming within their jurisdiction, irrespective of circumstances; whether it be a criminal, a person who was murdered or killed accidentally, an unconscious person, or one suffering from aphasia. Would it not save them considerable anguish if the police were in a position to notify parents or relatives in all such cases?

The unsuccessful attempts of the police to establish such a file is due to the fact that there is no law compelling it, and that whenever mention is made of finger prints the majority of persons not familiar with the system connect it with criminals, forgetting that the individuality of prints is not limited to criminals and that prints differ from photographs, inasmuch as they cannot be identified except by a duplicate set of prints, and then only by an expert.

Let us take into consideration the "Slocum" disaster on Long Island Sound a few years ago, when hundreds of human lives (mostly women and children on a church outing) were lost by drowning. How easily the bodies could have been identified and the parents or relatives notified; how it would have saved them the disagreeable and heartrending task of visiting the morgue every day in an endeavor to identify the bodies of their beloved ones as they were brought in. By finger prints all this could have been avoided and identifications made in a short time, whereas without them it required several days, and even then a large number were buried unidentified.

It would also be an aid to the public in the collection of life insurance, by supplying them with a positive proof of death of the insured, which no insurance company could ignore.

The Hon. Arthur Woods, Police Commissioner of the city of New York, is heartily in favor of establishing a general file of finger prints for Greater New York, and I have no doubt that permission will be granted upon application for the taking of finger prints in duplicate, so that a copy may be retained at home for future use to all persons who desire to aid in its establishment. The only persons who could have good reasons to object to finger prints are those with criminal tendencies.

The possibilities of the finger prints are numerous and varied, as they can be adopted wherever identity is to be proven or impersonation prevented, either under a system or classification, for which the services of an expert would be required, or without a classification, as in places where fictitious names are not resorted to.

A very interesting case in which a lone finger print was the important factor, even though it was not used for the purpose of obtaining a conviction, was the arrest of one John Bernauer.

On the night of January 25th, 1914, some person (unknown at the time) entered and burglarized the home of J. P. Morgan, Jr., at 231 Madison Avenue, New York city, without arousing the occupants, and succeeded in securing loot to the value of several thousand dollars, leaving no clew save the impression of one finger on a cigar lighter, which the perpetrator of the crime had handled but left behind as valueless. This impression was photographed by the police and compared with the prints of various suspects on file at the Bureau of Criminal Identification with unsuccessful results.

This impression took the course as many others had done before and was filed for future reference, when on September 20, 1914, seven months after the Morgan burglary, Detectives Doyle, O'Neill, and Tierney, who had been shadowing Bernauer for several days, arrested him on general principles as he was leaving a pawnshop, he seeming to have an over-supply of clothes and money for a baker out of work, when to their surprise they found upon his person a match safe and several other articles with the initials J. P. M., Jr., but as they could not at the time of arrest prove him to be the thief, he was charged with having stolen goods in his possession, which is a minor crime.

At the time of his arrest Bernauer denied all knowledge of the burglary, stating that it was given to him to pawn by one Muller, who could not be located, but after he was brought to police headquarters, finger-printed and shown that the print on the cigar lighter and the impression on his right middle finger were identical, he readily admitted his guilt; thus the impression of one finger was the direct cause of charging him with the burglary (a felony) and for which he was sentenced to not less than five nor more than ten years in Sing Sing Prison by Judge Swann on October 28th, 1915.

In Europe provisions were made for the admission of finger-print evidence as relevant, and while no such provisions exist in the United States, the judges and juries generally accept it as such, as shown in the case of one Charles Connors, alias "Ice Wagon Connors," who was arrested and convicted on evidence of a single print on the balcony railing of the home of Ernest R. Ackerman of Plainfield, N. J., which was entered on January 3rd, 1914, and jewelry to the value of $17,000 stolen. He was sentenced to serve from three to seven years, but as counsel did not believe the finger print evidence would hold, his case was appealed, with the result that on June 22nd, 1915, the Supreme Court at Trenton, N. J., confirmed the conviction and sentence, on the grounds that finger prints are proper and admissible as evidence.

A Successful Experiment in Skunk Farming

(*Concluded from page* 346)

skunks taken from the wild showed that for the most part the animals live on insects. Some were found to have dined off field mice, rats, squirrels and pocket gophers, carrion, lizards or salamanders, crawfish, fungi, earthworms, berries and fruit of various kinds. So fond are they of an insect diet that in the season when this provender is plentiful it has been found that they live on it to the exclusion of everything else. As the insect pest largely predominated in the stomachic contents of the skunks thus examined, the liking of the animal for grasshoppers, crickets, cicadas, army worms and such enemies of the farmer being apparent, the result proved that the skunk is a much maligned animal when he is classed among the wild things whose extinction would benefit the human family.

The skunk breeders take care that all the food they feed to their skunk family is well cooked; they claim this precaution is necessary to prevent stomach trouble. So they feed their colony on cooked vegetables and boiled horse flesh, with the remains of the family dinner and supper as a filler-in.

The captured skunk is rendered harmless by a simple operation. This operation sometimes takes the form of the removal of the scent sac, but more often resort is had to a method that is claimed to be just as efficacious and much more simple. The scent glands are located at the base of the tail. A contraction of the muscles enables the animal to eject the fluid. In extracting this scent sac the animal is put in a bag to keep him from biting and clawing and the gland is then removed. The wounds soon heal. The other method that the brothers use, and the one that is simpler than the complete extraction of the scent sacs, is the cutting of part of the duct. When a piece of this is snipped off the wound heals and closes the duct so that the skunk is perfectly harmless for the rest of his life. Deprived of this means of offense the skunk is as easy to manage as a cat or dog.

LEGAL NOTES

A very interesting decision has been handed down by the Supreme Court of the State of New York on a motion for a preliminary injunction in the case of Morris & Bendien vs. Alstedter.

It appears that the plaintiffs in about 1910 originated and marketed artistic plaques known in the trade as woodenettes. The plaintiffs having done a large business both in the United States and Canada, the defendants in June, 1915, asked plaintiffs for a price on the woodenettes in large quantities. Defendants objected to the price, gave no order for the goods and since September, 1915, sold in Canada large quantities of goods so resembling the plaintiffs' that the imitations, it is claimed, could have been made up only from photographic copies of plaintiffs' goods. The defendants not denying receiving the proceeds of the Canadian sales, contended the goods were not manufactured in the States but in Canada and that plaintiffs' trade-mark was never registered in Canada. Citing numerous cases the court in granting the motion for an injunction pendente lite, said,

"I am therefore of the opinion that in view of conduct of the defendant, it not being denied that he attempted to purchase from these plaintiffs goods, and upon their failure to agree upon the contract price that he, in going into the Dominion of Canada and manufacturing articles similar to those which the plaintiffs had manufactured for years, did so for the purpose of injuring these plaintiffs, and that such acts undoubtedly come within the definition of unfair competition."

The District of Columbia Court of Appeal.—In a series of fourteen decisions recently handed down in one day by the Court of Appeals of the District of Columbia, the Court affirmed the decision of the Commissioner of Patents in thirteen out of the fourteen, only reversing his decision in one case, that of Storck v. Reithhelm, the opinion being by Mr. Justice Van Orsdel. In the other thirteen cases six were ex parte and seven were contested cases.

Non-Registrability of Trademark Because Part of Corporate Name.— In re United Drug Company, the Court of Appeals of the District of Columbia held Stork as a trademark for rubber nipples not registrable because of the existence of a corporation named "The Stork Company," although the latter was not engaged in manufacturing nipples; also the same court in The Mansfield Tire & Rubber Co. v. Fort Motor Company held the word "Ford" unregistrable because it is the principal characteristic word in the name of the Ford Motor Company, holding at the same time that the name of a corporation is unregistrable to another regardless of the peculiar manner in which it may be written or printed.

In re Herbst the Court of Appeals of the District of Columbia recently held that where in a trademark interference the Patent Office decided that the mark was unregistrable to an applicant and no appeal was taken to the court, the question is *res adjudicata* and will not be reconsidered upon a new application merely because the applicant thinks a later decision by the court of appeals shows that the Patent Office was wrong in the first decision.

On appeal from the District Court in the Western District of Michigan the Circuit Court of Appeals in Cadillac Motor Car Company against Austin held that the Austin patent 1091618 for change speed gearing for automobiles was not anticipated and discloses invention, the device being the first practically operative two speed axle-drive gearing and also held claims 9 to 12 inclusive of such patent infringed.

Resolving Doubt in Favor of Applicant not Compulsory.— Commissioner Ewing in ex parte Poe, where the history of the application showed consistently dilatory prosecution, took occasion to say relative to solving doubts in favor of the applicant, as follows:

"The rule of reasonable doubt invoked by the attorney in a supplemental brief filed November 25, 1914, means that the existence and method of operation of an alleged anticipation must be established beyond a reasonable doubt. It does not mean that on the question of patentability over such an anticipation once established every reasonable doubt must be resolved in favor of the subsequent inventor. It is quite a common practice of the Office to resolve any doubt in favor of an applicant for patent; but there is no rule of law compelling this, and in many cases, a universal application of it is of questionable wisdom."

In reversing the decision of the Commissioner of Patents and holding that the application for cancellation of trademark should be dismissed in The Standard Brewing Company of Baltimore City v. Interboro Brewing Company, Inc., the Court of Appeals of the District of Columbia, by Mr. Justice Robb, says,

"The statute was intended as a shield to the innocent, rather than as a foil to the guilty. The appellee, on its own showing, has no right whatever to the use of this trade-mark. How, then, can it be injured by its registration by the appellant? It is not concerned with the question whether the appellant's right to the mark is superior to that of the third party. If that party deems itself injured by the registration it may invoke the provisions of this statute, but certainly an interloper has no standing to invoke it."

A Decision as to Patentable Novelty.—In the decision in re Miehle Printing Press & Mfg. Co. v. Whitlock Printing Press Mfg. Co., Mr. Justice Lacombe, in the course of his decision, went on to say, "Patentable novelty is sometimes found in discovering what is the difficulty with an existing structure and what change in its elements will correct the difficulty, even though the means for introducing that element into the combination was old and their adaptation to the new purpose involves no patentable novelty."

A Crown Seal Cork Decision.—Mr. Justice Dennison in Crown Cork & Seal Co., of Baltimore city v. Sterling Cork & Seal Co., goes on to say, "Having gone into the yielding plunger art and adopted and adapted the hydraulic cylinder yielding plunger into and for a bottle sealing machine and having thus bridged over whatever gap there was between bottle sealing machine and yielding plungers, and having thus incorporated the two arts together, he could not the next year adapt a mechanical trip yielding plunger to bottle sealing machine use and then get a valid patent covering any kind of a mechanical trip yielding plunger when used in a bottle sealing machine.

Disposal of License.—Judge Lacombe says, referring to a lessee of a patented machine, "We do not see why he may not give the lease to whomever he pleases * * * provided he * * * turns the machine over with the license label or other company marks affixed to the machine intact and unaltered so that his assignee may be fully advised of the conditions under which use of the machine is licensed. Victor Talking Machine Co. v. Strauss, et al.

Invention "On Sale."—In Wende v. Horine it was held that an offer to sell made to a prospective purchaser after the experimental stage has passed, the invention reduced to practice and the apparatus manufactured in its perfected form is a placing on sale within the statute.

Government Contractor Not Liable for use of Patented Inventions.—Owners of patents claiming infringement of their rights by contractors to the United States cannot interfere with execution and delivery by suing contractors and may obtain relief only from the Government itself, according to the recent decision of the Court of Appeals in the Marconi-Simon case.

The Marconi Company sought an injunction to prevent Emil J. Simon from producing twenty-five wireless sets for

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submarines of the United States Navy on a contract awarded him for delivery January 1st, 1916.

The plaintiff claimed infringement of the basic Marconi patent, while Simon maintained that any action should be brought against the Government itself for demanding the precise arrangement in its specifications. Walter H. Pumphrey, Esq., acting for the defendant and also for the Secretary of the Navy, stated that the court action was a menace to national safety in that it threatened to prevent delivery of apparatus necessary to the Navy, and would force disclosure of valuable secrets of adjustment and operation discovered by Government experts. A letter from the Secretary of the Navy was also submitted to the Court presenting the Government's desire that its work should not be interfered with.

The case was decided by Judge Hough of the United States District Court, based on a previous ruling of the United States Supreme Court in the case of Crozier vs. Krupp, and was affirmed by the United States Court of Appeals to the effect that no cause for action of any kind arises against a contractor to the United States Government through the use of a patented invention in carrying out such contracts. The theory basis is that the use of a patented invention by or for the Government, is a use by the Government as a licensee (under an act of Congress of June 25th, 1910), and the only recourse for the plaintiff due to such use is by action in the Court of Claims against the Government for royalties, as is distinctly provided for by the act.

Before the act of 1910 recovery from the Government was possible only when an actual license agreement (expresed or implied) existed between the Government and the owner of the patent; and therefore in many cases recovery of royalties was imposible. The act of 1910 makes the Government a licensee by law whenever it makes use of a patented invention, and provides for full compensation in all cases.

The decision of the Court of Appeals was handed down March 15th, 1916.

NEW BOOKS, ETC.

ELEVATOR. A Practical Treatise on the Development and Design of Hand, Belt, Steam, Hydraulic, and Electric Elevators. By John H. Jallings. Chicago: American Technical Society, 1915. 8vo.; 224 pp.; illustrated. Price, $1.50.

The popular conception of the modern elevator generally leaves out of account the time and inventiveness that has led up to its present state of perfection. It is in reality a microcosm of the history of mechanical invention, evolved feature by feature from the unwieldy "sling" lift of fifty years ago to the admirable equipment of the Woolworth Building, with its exacting demands of load, speed, and control. The illustrations, with which Mr. Jallings' work fairly teems, constitute a pictorial history of the development of the elevator. Hand-power, belt-power, and worm and gear installments are followed by steam, hydraulic, and electrical equipments. The author has not only witnessed this evolution: he has himself materially contributed to it; hence his very lucid exposition of fifty years of progress should find an honored niche in our as yet rather diminutive library of elevator construction and design.

OXY-ACETYLENE WELDING AND CUTTING. Electric, Forge and Thermit Welding. By Harold P. Manly, Chief Engineer the American Bureau of Engineering. Chicago: Frederick J. Drake & Co., 1916. 12mo.; 215 pp.; illustrated. $1.00.

The author presents in a single handy volume not only oxy-acetylene welding processes, but also such auxiliary operations as annealing, tempering, hardening, heat treatment, and the restoration of steel. He deals, too, with the various metals, with the production and handling of the gases, and with the tools and accessories. So good is his arrangement of material, and so thoroughly has he pruned his work of all repetition and mere theory, that every essential of present-day practice is adequately set forth, and the welder and metalworker has only to refer to a detailed index to obtain immediate and accurate information upon any point.

THE WRITERS' AND ARTISTS' YEAR-BOOK, 1916. A Directory for Writers, Artists and Photographers. Edited by G. E. Mitton. London: A. & C. Black, Ltd. 8vo.; 190 pp. Price, 1s. net.

The American freelance who knows something of English requirements may often dispose advantageously of fiction and articles in the English market; to offset the lower

rate paid, material that is trite with us may be fresh and unusual to those living in a foreign environment. The directory also lists the leading periodicals of the United States and Canada. The requirements of each magazine or paper are carefully detailed, with the length stories and articles should run, the type most desired, and the rates usually paid. The nature of the illustrations used is frequently indicated, thus making the work valuable to artists as well as to writers. There are numerous minor mistakes, but none that seriously impairs the reliability and usefulness of the work.

HOUSE WIRING. By Thomas W. Poppe. New York: The Norman W. Henley Publishing Co., 1916. 16mo.; 125 pp.; fully illustrated. Price, 50 cents.

"House Wiring" is a very business-like little treatise, now in its second edition, in which the installment of electric light, bells, and burglar alarms is described from the modern standpoint and with commendable simplicity. Apprentices, helpers, and electricians will find in it the solutions of most wiring problems, and its practice is in strict conformity with the rulings of the National Board of Fire Underwriters.

THE VENTILATION HAND BOOK. By Charles L. Hubbard. New York: The Sheet Metal Publication Company, 1916. 8vo.; 250 pp.; 137 engravings. Price, $2.

Using the question-and-answer method, the author unfolds the principles and practice of warm-air heating and ventilation. Simple rules are formulated for computing cubic contents and grate sizes, with many convenient tables dealing with such matters as the effects of gas jets and lamps upon ventilation, and fan diameters and horse-powers for fan-drive installments. Everything is so plainly put that the reader has no excuse for misunderstanding, and it would be hard for the student to find a more serviceable introduction to the subject. The work is also well adapted for reference use, and the householder, who is about to install a furnace, and who has a laudable desire to understand just what his conditions call for, and why, cannot go far astray if he will study the last chapter of the book.

INDUSTRIAL LEADERSHIP. By H. L. Gantt. New Haven: Yale University Press, 1916. 12mo.; 128 pp.; 6 charts. Price, $1 net.

The published addresses which make up this volume embody the principles of industrial leadership, the training of workmen, the proper bases for task work and its results, and the subject of production and sales. The author, who is well known in the field of scientific management, believes that the coming industry will achieve success by teaching and leading its workers rather than by driving them, and that democracy is to be vindicated in corporate as well as in national affairs. Actual examples are cited of the improvement in task work by the establishment of the new methods, and these examples are illustrated by diagrams and charts. The work carries both inspirational and practical elements, and its suggestions bear the stamp of authority.

LATHE DESIGN, CONSTRUCTION AND OPERATION. With Practical Examples of Lathe Work. By Oscar E. Perrigo, M.E. New York: The Norman W. Henley Publishing Co., 1916. 8vo.; 500 pp.; 341 engravings. Price, $2.50.

The old, primitive lathe set up between two trees has developed into some of the most important and indispensable machinery known to the industrial world. This most interesting and comprehensive volume traces its rise from the above-cited crude beginning, through the foot-power stage, on to the development of the screw-cutting or engine lathe of a half-century ago. This careful preparation furnishes an excellent groundwork for the study of the strictly modern forms; up-to-date design is most thoroughly discussed in all its aspects, and the essential differences of the various types are clearly disclosed. This is followed by a chapter on installation, care, and operation—a new feature of the enlarged addition of the work. Drilling and milling attachments are minutely described, together with a selection of the more difficult machining operations. Even the novice will here find such pointed exposition of modern practice as should directly contribute toward his rapid progress. The letterpress instruction is supplemented by lavish diagrams and engravings that put all important features and accessories before him in an impressive and unforgettable manner.

HARPER'S HYDRAULIC TABLES. For the Flow of Water in Circular Pipes Under Pressure, Timber Flumes, Open Channels, and Egg-Shaped Conduits. By Joseph H. Harper. New York: D. Van Nostrand Company, 1916. 16mo.; 192 pp. Price, $2 net.

The convenient arrangement of Mr. Harper's material and the wide range of problems it covers should make this compilation eminently useful in actual field service. Canal beds frequently change from solid rock to loose earth, sand or gravel, necessitating a prompt change in proportions and grade. This makes it necessary to incorporate into the working formula an element corresponding to the degree of roughness, and the author has paid particular attention to this condition in the tables he gives us. They will materially assist the field worker in making his computations.

Kindly keep your queries on separate sheets of paper when corresponding about such matters as patents, subscriptions, books, etc. This will greatly facilitate answering your questions, as in many cases they have to be referred to experts. The full name and address should be given on every sheet. No attention will be paid to unsigned queries. Full hints to correspondents are printed from time to time and will be mailed on request.

(14077) L. A. W. asks: I have noticed very frequently in views of moving picture shows, where a wagon or automobile is moving, that many times the wheels are revolving backwards. A. The spokes of a wheel on a moving vehicle in a moving picture may appear to stand still, to move forwards or backwards. Which it shall be depends upon the speed of the wheel as compared with that of the shutter of the camera. As you probably know there is a revolving disk in the camera which cuts off the light many times a second. The film is at rest in the camera while the light falls upon it, and when the light is cut off, the film is moved into its position for the next exposure. If the spokes of the wheel turn just as fast as the exposures are made so that the spokes are in the same positions on the film in successive exposures, the wheel will appear to stand still on the screen. If it turns enough faster so that a spoke is in front of the position of the last exposure each time, the wheel will seem to turn forwards. If a spoke in the next exposure is behind the last position of the spoke which is in front of it as the wheel turns, the wheel seems to turn backwards.

(14078) A. G. asks: Please inform me as to where thermopiles can be bought. I am interested in thermopiles that would yield a current about equal to that of a Bunsen cell or Grove cell, at least as near as obtainable. A. No thermopiles for commercial purposes are to be had, so far as we know. The thermopile can be made to give the voltage of a Bunsen cell with a sufficient number of couples, but we have never seen one which could give as many amperes as the Bunsen cell. An effort was made some years ago to make one which would charge a battery for ignition purposes on an automobile, but it was not a success. We have one in our laboratory, kept as a curiosity now.

(14079) F. F. H. asks: 1. What are the reasons that liquid air has not been put to the practical uses suggested for it when it was first made? Is there any use made of it at present? 2. What is the cause of the temperature dropping 2 to 6 deg. Fahr. just at sunrise on clear cold mornings. 3. What is the nature and cause of "ball" lightning. A. 1. Liquid air is poorly adapted to the uses which were suggested for it when it was first made in large quantities—that is, for refrigeration and for power. Its latent heat of evaporation is small and its specific heat is also small. It cannot compete with ammonia for refrigeration. It cannot be kept in a closed vessel, but must always have a vent to the air. For explosives many better materials are available. It is used to some extent to secure the oxygen of the air by first liquefying the air and then boiling off the nitrogen, which boils at a lower temperature than the oxygen. 2. It is coldest just about sunrise every morning. The ground radiates heat through the night and until the sun begins to warm the ground again. We were not aware that there was a sudden drop of temperature just at sunrise. 3. Ball lightning is not well understood.

(14080) W. R. H. asks: I have a lady friend, who has the peculiar—to me—faculty of seeing and of stating the colors of names and sounds. There is no doubt about her ability to do this, and to do it accurately. I have tested her. For instance, I have written a list of names—she has stated the color of each name as soon as I called it. I have set her answer down and filed the list—and several months after I have called the list to her and she would state the colors exactly as she did at first. Is there a scientific basis for this? A. You will find several articles upon Color Music in the SCI. AM. within the last year, in Vol. 112, No. 15, and Vol. 113, Nos. 4 and 9, which we can send to you for ten cents each. We confess the whole thing seems a fancy to us, but if it is real to those who see it that way, why should we object. There can be no doubt of the reality of the association of sounds or persons and corresponding colors. What association has produced the connection we cannot say, nor whether different persons would or ought to have the same scale of association as they should have if there is other than an arbitrary or individual basis for the association.

(14081) G. M. asks: By what methods can china, earthenware, plaster of paris and articles of like nature be given a coat of metal by electric deposition; in other words, electroplated? If this happens to be of a too complicated nature to permit of a brief description, would you kindly refer me to books or technical articles covering this subject? A. China, earthenware and similar articles are prepared for electroplating by first putting on a coat of tough varnish. When this is dry the varnish

is covered with plumbago, which furnishes a conducting coating for the deposit of the metal from the electroplating bath. Full particulars are given in "Watt's Electroplating," which we send for $4.50.

(14082) J. L. asks: I fear this following question has often been asked you, but I would like to know if a bullet from a rifle fired perpendicular into the air has the same force when it comes back to earth as it does when it leaves the muzzle of the rifle? Will it show the same penetration? It is generally taught in physics that it falls with equal velocity as it ascends. Is there a certain definite relation between velocity and force? A. A bullet fired vertically into the air does not have the same force when it strikes the ground upon its descent as when it left the muzzle of the gun upon its ascent. The resistance of the air to rapidly moving bodies is very great. We have recently published diagrams of the paths of projectiles from high powered guns, showing the difference between the theoretical and actual trajectories. You will find the article in the Sci. Am., Vol. 112, No. 21, price ten cents. The resistance of the air reduces the velocity of the ascending ball so that it does not rise to the height indicated by its muzzle velocity. It therefore starts to fall from a lower than the theoretical point, and the air retards its fall so that it does not acquire its full velocity of fall from the point from which it actually began to fall. For both reasons it does not make so much penetration on its return. The teaching of the text books of physics that bodies fall in the reverse order of their ascent and strike with the velocity with which they started, is based upon the omission of any other forces than that of gravity. It is usually so stated. In one text now before us is the statement, "The resistance of the air is neglected in this discussion of projection upward." Other things being the same, a given force always produces the same velocity.

(14083) G. J. asks: Will you kindly answer through your "Notes and Queries" column the following: If a weighing scales, such as used by druggists, were inclosed in a glass case in two compartments, with equal weights at each end, and the air extracted from one compartment, would it make the other side heavier and cause it to tilt? A. If the two pans of a balance were enclosed in separate compartments and accurately balanced, and the air were then exhausted from one compartment, the pan in the compartment from which the air had been exhausted would become the heavier and would tilt down. The air buoys up a body in it as really as water does, and so when the buoyancy of the air is removed that body seems to become heavier. In accurate weighing the buoyancy of the air is allowed for and the weight of a body is taken to be its weight in a vacuum, not its apparent weight in the air. The difference is quite considerable for light substances.

(14084) H. M. asks: 1. Has there been any decided change in the climate of this region in the last hundred years? I notice that most old people say that the winters are not nearly so cold now as they were when they were young. 2. Please explain the formation of ice spears that come up out of loose ground. I notice the phenomenon often in this latitude. Do we have frost when the thermometer registers higher than 32 deg.? I have heard it stated that we did. A. 1. Weather data as secured by the U. S. Weather Bureau do not bear out the claim so often made that the climate is changing. The differences are about the same as they have always been. Warm winters are succeeded by cold ones, and for several years it may seem that the winters are warmer, but the years of cold winters follow and when the averages are struck it is found that hot and cold, wet and dry seasons follow along as they used to do "when we were boys." It is very difficult to tell how cold it was when we were young, unless there is a record of a thermometer to be referred to. One's recollection is very unreliable in such matters. 2. The ice spicules which are seen in cold weather in loose soil grow by chilling the moisture of the air and freezing it upon the sides and top of the ice form. Frost cannot occur unless the temperature at the place where the frost appears is as low as 32 deg., the freezing point of water. A few feet or inches even away from where the frost appears it may be warmer than 32 deg. The green leaves are colder than the air near them and they may be frost-bitten while close to them, frost may not be seen.

(14085) B. F. asks: 1. What direction has the atmosphere *above* the equatorial belt of calms by reason of the earth's rotation, east to west or west to east? If these are deflected to the west as are those on the earth's surface, how can they be turned to form the prevailing westerlies when they return to the earth's surface in the horse latitudes? 2. What is the direction of the circumpolar whirl? Is there a difference in direction at the earth's surface and in the winds high above the earth's surface at the poles? 3. If a Crookes radiometer reacts to waves of radiant energy, which will pass through an opaque solution, which waves are not of the proper length to affect sight why will it not react to waves radiating from a stove, which waves do not affect the sense of sight? 4. Is there no radiant energy in diffused sunlight, since the radiometer does not react unless in direct sunlight? 5. Can the radiant energy be proven less in reflected direct sunlight than in direct sunlight? A. 1. The current of air flowing to the north above the

northeast trades in the Torrid Zone is deflected toward the east by the rotation of the earth. This is stated as a law in meteorology: "If a free-moving particle (such as air) is moving along near the earth's surface, there is a force arising from the diurnal rotation of the earth, which deflects it to the right of its course in the northern hemisphere, and to the left in the southern hemisphere." Therefore, wind moving from north to south in the northern hemisphere is deflected towards the west forming the northeast trades, and the winds moving from south to north are deflected towards the east forming the southwest winds. All these matters of the winds are well-discussed in Waldo's Elementary Meteorology, which we can supply for $1.50 net, postpaid $1.65. 2. The winds around the north pole are southwest for the reason stated above. They are moving from a place where the earth is rotating faster to one where it is rotating slower, and retain to a degree the eastward velocity of rotation of the place from which they have come. They will move eastward faster than the surface of the earth where they are and have an eastward motion, thus becoming southwest winds. 3. A radiometer will react or rotate by the heat from a black stove, or a black iron ball, which can be safely touched with the finger. We have a radiometer which will turn from the heat radiated from water above 50 deg. C. or 122 deg. Fahr. in a dark room. At this temperature the radiometer ceased to rotate. 4. There is a great deal of radiation from the sky outside of direct sunlight. To-day has been a dark snowy day, yet the radiometers have been turning in the windows all day slowly to be sure, but moving all the time. 5. If sunlight is reflected several times it becomes enfeebled to a high degree. Each mirror absorbs some of the radiant energy, and it can then be seen that the speed of the radiometer is reduced. It would seem that your radiometer is not very sensitive if it will not turn by the heat of a stove, or in diffused sunlight as it comes from the sky in a cloudy day.

(14086) H. C. M. writes: Permit me to call attention to an apparent error in the answer No. 14050, page 209, of the issue of Feb. 19th, 1916. Referring to the expansion of gases, it is stated that the rate is $\frac{1}{459}$ of the volume at freezing for each deg. Fahr. Gay-Lussac's Law states that "Under constant pressure, the volume of a gas varies directly with its Absolute Temperature," and the rate of expansion is $\frac{1}{273}$ per deg. C. of its volume at freezing. This, then, calls for a rate of $5/9 \times \frac{1}{273} = \frac{1}{491.4}$ per deg. Fahr.—a fact also evident from the fact that on the Absolute Fahrenheit scale, the freezing temperature is 459.4 + 32, or 491.4 deg. instead of the 459 deg. which your answer implies. A. We thank you for calling attention to the typographical error in giving the number of degrees Fahrenheit from the freezing point down to Absolute Zero, as 459, in place of 491, which is the correct number. Absolute Zero is 459 deg. below Fahrenheit Zero, not below the Fahrenheit freezing point of water, which was intended in the answer.

(14087) H. R. P. asks: Will you please tell me how the correct time is taken at Washington. B. claims it is taken from the sun. A. claims the sun is not correct, and the time is figured from the stars. Which is right? A. The time for any place can be determined from observations either of the stars or the sun. From the observations which give the sidereal time, the solar and Standard time can be calculated. We use Eastern Standard Time in New York. This is five hours earlier than Greenwich Time. It is not solar time. It is the mean solar time of the 75th meridian west of Greenwich.

(14088) R. R. asks: A tank 6-6 feet square, with a 1½-inch pipe attached to bottom of the tank 20 feet long, with a gauge at the bottom of pipe. Then take a pipe, 26 feet long, 1½ inches in diameter, and a gauge at bottom, will there be any difference in the pressure and how much? Both tank and pipes filled with water. A. The pressure at the gauge is the same in both the cases which you show in your sketch. The size and shape of the vessel have no effect upon the rate of pressure at the bottom. The rate of pressure is determined by the head of water and by no other factor. This pressure for a head of 26 feet is 11.7 pounds per square inch.

(14089) C. S. B. asks: In an article that appeared recently in the SCIENTIFIC AMERICAN, ammonium carbonate was said to be a test for alum in bread. The writer said that if bread with alum in it were moistened with a solution of ammonium carbonate, the bread would turn black. What is the chemical reaction? And why will not ammonium carbonate turn alum solution black? A. There is no chemical reaction between alum and ammonium carbonate which can produce a black substance. There is some mistake in reference to this as a test for alum in bread. The tests for alum are not easy of application without experience in chemical manipulation. The easiest, perhaps, is to dry the bread and burn to ashes. Digest the ashes with a small quantity of water, then acidify this solution with hydrochloric acid, and add a few drops of barium chloride solution. If alum is present a white precipitate appears.

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