SCIENTIFIC AMERICAN

ANIMATED CARTOONS IN THE MAKING: FILMING THE SUCCESSIVE DRAWINGS.—[See page 354]

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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.

The New Naval Reserve Force

THE section of the great naval bill passed by the 64th Congress which relates to the formation of an adequate Naval Reserve Force seems to be well calculated to fill what has hitherto been a most serious gap in the naval defenses of the United States. We present here a digest of this section of the bill, which will be found printed in full in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT.

The new Naval Reserve Force is to consist of the following six classes: The Fleet Naval Reserve; The Naval Reserve; The Naval Auxiliary Reserve; The Naval Coast Defense Reserve; The Volunteer Naval Reserve; and, the Naval Reserve Flying Corps.

The Naval Reserve Force will be composed of citizens who obligate themselves to serve in the Navy in time of war, or during the existence of a national emergency declared by the President. The members will carry the various ratings, grades and ranks, not above the rank of Lieut. Commander, corresponding to those in the Navy. Enrollment and reënrollment must be terms of four years; but in time of peace members may be discharged upon their own request. When first enrolled, members will be given a grade, rank or rating in accordance with their qualifications. No one will be appointed or commissioned as an officer in the Naval Reserve Force, unless he shall have been examined for such appointment by a board of three naval officers. The retainer fee of all members, except the Volunteer Naval Reserve, shall be $12.00 per annum, and this to be in addition to any pay to which any member may be entitled in active service. After they have been confirmed in their rank or rating, the retainer pay will be that prescribed for members in the various classes.

The enrolled members of the Force will be subject to the laws, regulations, etc., that govern the regular Navy, only during such time as they are required to serve in the Navy. All members of the Naval Reserve Force will receive a distinctive badge or button which may be worn with civilian dress. All members, when actively employed, will receive the same pay, allowances, etc., as officers and men of corresponding rank, etc., in the Navy. The members, upon first reporting for active service, for training, during each period of enrollment, will be credited with a uniform gratuity of $50.00 for officers and $30.00 for men. In time of war these sums will be increased to $150.00 and $60.00 respectively.

The Fleet Naval Reserve will consist of officers of the United States Naval Service and citizens who have been honorably discharged from the Naval Service after not less than one 4-year term of enlistment, and who shall have enrolled in the Naval Reserve Force. Furthermore, the Secretary is authorized to transfer to the Fleet Naval Reserve, at his discretion, any enlisted man of the Naval Service, with twenty or more years' Naval Service, or any enlisted man who may be entitled to an honorable discharge, such transfers to be made only upon voluntary application. Men enrolled in the Fleet Naval Reserve with less than eight years Naval Service will receive $50.00 per annum. Those with eight to twelve years' service, $72.00 per annum; and those with twelve or more years' service, to be paid $100.00 per annum. Reënrollments in the Fleet Naval Reserve may be for four years.

The Naval Reserve, the second of the six classes above enumerated, will consist of members of the Naval Reserve Force engaged in the sea-going profession, who have enrolled for general service. The minimum active service required of members to qualify for confirmation in their rank or rating in this class is three months.

The third class, the Naval Auxiliary Reserve, will consist of members of the Naval Reserve Force of the sea-going profession, who shall have been or may be employed on American vessels of the merchant marine of suitable type for use as naval auxiliaries. In time of war, the members of this reserve will be required to serve only in vessels of the merchant ship type.

The fourth class consists of the Naval Coast Defense Reserve, which will be made up of members of the Naval Reserve Force who may be capable of performing special useful service in the Navy or in connection with the Navy in defense of the coast. The members of this class may enroll for service in coast defense vessels, torpedo craft, mining vessels, patrol vessels, or as radio operators, in various ranks or ratings corresponding to those of the Navy for which they shall have duly qualified; provided that the Secretary of the Navy may permit the enrollment in this class of owners and operators of yachts and motor-power boats, suitable for naval defense of the coast, and contracts with the owners of such power boats to take over the same in time of war upon payment of a reasonable annuity.

The fifth class, to be known as the Volunteer Naval Reserve, will be composed of those members of the Naval Reserve Force who are eligible for membership in any one of the other classes of the Naval Reserve Force, and who obligate themselves to serve in the Navy in any one of said classes without retainer pay and uniform gratuity in time of peace.

The sixth class, to be known as the Naval Reserve Flying Corps, will be composed of officers and student flyers, who have been transferred from the Naval Flying Corps to the Naval Reserve Flying Corps, and also of enlisted men who shall have been so transferred under the same conditions as those provided by law for enlisted men of the Navy transferred to the Fleet Naval Reserve.

American Weather Forecasting

FOR some months rumors have been abroad that the Weather Bureau was preparing to publish a comprehensive book on weather forecasting. These reports are now verified by the appearance of a portly volume bearing title, "Weather Forecasting in the United States," comprising contributions from most of the Bureau's specialists in this field of activity, and put together by a board, of which Prof. A. J. Henry was chairman. The need of such a work is explained in the preface by the statement that "although the Weather Bureau has been successfully forecasting the weather for many years it is a rather notable fact that scarcely anything has been written to explain, more or less in detail, the processes by which good forecasts are made."

It is not much more than half a century since the term "forecasting" was first applied specifically to the prediction of weather by the British meteorologist FitzRoy, who, in choosing this name for an art then in its initial stages, sought to avoid the undesirable connotations of the words "prognostic" and "prophecy." Weather prognosticators and weather prophets antedate the science of meteorology—and their unscientific successors are still with us. The weather forecaster, properly so called, is both scientific and modern.

Weather prediction from synoptic charts—dreamed of by Lavoisier, Kreil, Glaisher, Espy and Henry, and realized within the memory of men still living by Leverrier, FitzRoy, Buys Ballot, Abbe and the United States Signal Service—is still on the defensive against criticism and skepticism, as it was when the conscientious and sensitive FitzRoy took his own life because the public would not take his work seriously. To a certain extent its attitude is defensive even toward meteorologists. The meteorological establishment that, in a scientific sense, perhaps stands highest in Europe—the Royal Prussian Meteorological Institute—has never seen fit to undertake weather forecasting. There is a conspicuous hiatus between meteorology as a science and meteorology as an art applied to predicting weather; though step by step this gap is being filled. Forecasting is still frankly empirical.

Hence the Weather Bureau's new book is a record of experience. The millennium of comprehensible weather has hardly yet arrived; but the advantages of knowing the weather's habits, even though we cannot read its inner consciousness, are so great that the expense of maintaining a Weather Bureau is insignificant in comparison with them. In the book now before us we have the habits of American weather catalogued and classified down to the smallest local mannerism. The book represents the first attempt to bring together a valuable body of traditional knowledge, with the addition of ideas developed, but perhaps not hitherto fully crystallized in their own minds, by the present generation. Certainly it is a work of immense utility to the men who wrote it.

The introductory note by the Bureau's chief, Professor Marvin, deals in an illuminating way with the theory of atmospheric motions. This chapter is comparable to much that is of most interest to meteorologists in the somewhat analogous book on forecasting published a few years ago by the director of the British Meteorological Office, and which represented the collective wisdom of the British service as this work does that of our own. In the next chapter Professor Humphreys gives us a welcome digest of what is known about the general circulation. Then Professor Henry takes his turn, and unfolds the subject of forecasting proper. It is hardly too much to say that the work which he has put into this book is monumental. His contributions furnish a vivid picture of the forecaster's mind at grips with some of the most bewildering tasks ever allotted to man.

Professor Cox's contributions on the prediction of frost, Mr. Bowie's on that of high winds and on long-range forecasting, Professor Frankenfield's on snow, sleet, ice storms and fog, and the many monographs of a regional or local character by the district and minor forecasters, all help to make this work one of the most notable that has recently been published by any scientific bureau of the Government.

The 18-inch Naval Gun

AT the very time when a lively discussion is being carried on in our Navy Department as to whether the 14-inch or the 16-inch gun is the most efficient piece for the main batteries of our warships, word has come to official Washington, probably through our Naval Attaché, that the British have completed an 18-inch type gun, and that their latest dreadnoughts are to be armed with this enormous piece, the size and power of which will be understood when we remember that the largest piece now mounted in our Navy, the 14-inch, weighs sixty-three tons and fires a projectile of fourteen hundred pounds weight as compared with a probable weight of one hundred and fifty tons for the 18-inch gun and a weight of about three thousand pounds for its projectile. If the report be true, and we understand that it is credited by our Naval officers in Washington, it is in full accord with the recent trend of naval ordnance and it is guaranteed by the ever-increasing ranges at which naval actions have been fought during the war.

As we recently pointed out, the ships of the British Admiral Cradock were sunk at twelve thousand yards, and those of Admiral von Spee at fifteen thousand yards; while the North Sea engagements between the British and German fleets opened at ranges of from seventeen to twenty thousand yards. That accurate shooting can be done over these great distances is suggested by the recent performance of the "Pennsylvania" in putting eight out of twenty-four shots into the target at a range of twenty thousand yards.

Now, it was inevitable that the increase of the fighting range would be followed by an increase in the caliber of the gun, for the reason that as the range increases the punishing power of a big gun diminishes less rapidly than that of a smaller gun. Hence, if two fleets are able to do equally accurate shooting at, say, twenty thousand yards, it follows that the fleet which mounts the heaviest gun will do the greatest damage with each individual projectile that gets home on the enemy. It is well understood that only a certain amount of a ship's displacement can be allotted to her armament. If she carries a numerous lighter battery, she will land a proportionately larger number of shells on the enemy. If she mounts a smaller number of very heavy guns, like the English 18-inch piece, fewer hits will be obtained, but the damage done by each of the larger shells will be enormously greater.

It is not the number of shells that strike a ship, but the number of shells which get into the ship by penetrating her armor, that settle the question of her remaining afloat to fight, or going to the bottom. Moreover, of the shells that penetrate the armor, those of the largest caliber will do the most disruptive damage. Their fragmentation is larger, and each flying piece has therefore a proportionately greater tearing and penetrating effect. The fragments of a 12-inch shell which had come through the armor might fail to get through the protective deck into the vitals of a ship; whereas, the larger fragments of a three-thousand-pound shell might well be able to get through.

It is a suggestive fact that two of the British battle-cruisers destroyed by gun-fire in the Jutland battle received the fatal blow through the comparatively thin armor on the roof of their turrets, the exploding shell serving in some way to set off the magazines or a heavy local accumulation of shell and powder, and so tearing the ship asunder. Such penetration of horizontal or comparatively horizontal armor becomes increasingly possible as the fighting range increases and the angle of fall of the shell becomes steeper.

Furthermore, there is a steady increase of accuracy with the increase of size of gun and weight of projectile. More accurate shooting can be made with an 18-inch gun than with a 12- or 14-inch gun, particularly at the longer ranges. The modern system of spotting from an elevated position makes it possible to pull the salvos on to a ship at unbelievably great distances,—provided, of course, that the atmospheric conditions give good visibility. A skilled spotter, slung in a boatswain's chair from the masthead, would be able in clear weather to direct a salvo of 18-inch guns with deadly accuracy upon a battleship twenty-five thousand yards distant.

Electricity

Electrically-Heated Fire Engines.—The Spokane fire department is at present testing an electric boiler heater as a substitute for artificial gas or coal in keeping water warm in fire engines between calls.

How Wall Paper Saves Electricity.—Too many of us in choosing wall paper lose sight of the illuminative value of various shades, and of consequent increase in the cost of properly illuminating the rooms being papered. With the light wall papers now much in vogue, particularly the light browns and grays, a minimum of electric illumination is necessary for satisfactory results.

Cooking by Electricity.—According to Mr. H. C. Hopkins, writing in a recent issue of the *Electric Journal*, cooking by electricity effects a considerable saving in the weight of the cooked meat. Ribs of beef, states this authority, cooked by coal lose 21 per cent, as against 18.6 per cent when cooked electrically. Mutton, 31.7 for coal, as against 15.8 for electricity. Shoulder of mutton, 25.7 by coal, as against 11.1 per cent by electricity.

Electric Railroads in Sydney.—The *Engineer* states that the report on the new electric railways of Sydney, Australia, has now been published. The inner zone railways to Parramatta, Hornsby, Sutherland, and Bankstown are to be changed from steam to electric traction, the city line is to be rebuilt, and lines laid to the eastern, western, and northern suburbs. Two cantilever bridges are to be erected across the harbor, small branches electrified, and an underground railway constructed. The total cost will probably be in excess of $100,000,000.

Three Gloves in One for Protective Purposes.—A New York public service company is at present considering a new type of protective glove for the use of its employees working on high tension circuits. In reality, the new glove consists of three separate gloves: the first is a cotton glove which fits closely to the hand; the second is a thin rubber glove which affords the necessary insulation from high tension currents, and the third or outer glove is of horsehide, affording mechanical protection. The three-ply glove is ventilated on the back where protection is not required. Aside from the excellent mechanical and electrical protective features of the glove, it is exceedingly flexible and does not materially hinder the dexterity of the worker.

Two-Speed Alternating Current Elevator Motor.—In a recent issue of the *Electric Journal* there appears a description of a two-speed alternating current elevator motor. The distinctive feature of the motor is the use of two windings on both the stator and rotor. These windings on a 60-cycle circuit give speeds of 250 and 840 revolutions per minute, respectively. On starting, the lower speed winding is connected to the circuit, and when the motor attains its maximum speed which corresponds to a car speed of 120 feet per minute, the connections are automatically changed to the higher speed winding, with a resistance in the rotor circuit. Finally, this resistance is cut out, bringing the car to its maximum speed of 400 feet per minute.

Safety Screw-Base Receptacles.—Although the screw-base type of flush receptacles is the only design which accommodates all makes and styles of attachment plugs, its use has been somewhat limited in the past because of the fact that the "live" parts are in such a position as to result in shocks to children and the inquisitive laity, as well as in serious short circuits. There has lately been developed a screw-base flush receptacle in which both contact members are normally "dead." The center contact has to be pressed solidly inward, while the outer or shell contact has to be drawn outward. Both these operations are automatically performed when the attachment plug is screwed in place. Upon withdrawing the plug, the contact members again become "dead." Incidentally, the breaking of the circuit through the receptacle mechanism reduces the arcing at the end of the attachment plug, which often gives rise to serious complications.

The Industrial Light Business, states the *Electrical Review*, in which the greatest expansion has occurred during the year, has been cared for almost exclusively by the high efficiency filament lamp, due to lower installation cost. A large increase in the number of such installations on series circuits, replacing inclosed carbon arc lamps, has been one of the most noticeable features. This is directly attributable to the fact that fixtures for the operation of 400, 600 and 1000-candlepower, 15 and 20-ampere nitrogen-filled lamps can be substituted for the inclosed arc lamp on existing arc circuits without it being necessary to change any of the other equipment. Such a lamp will give three times the amount of light with the same power consumption. Furthermore, by a slight modification—omitting the autotransformer and putting in a multiple socket—the same fixture can be used for yard lighting or outdoor display lighting, as it is particularly designed to protect the lamp in exposed locations.

Astronomy

Barnard's Runaway Star.—Further studies have been made of the star, recently mentioned in these columns, discovered by Barnard to have a larger proper motion than any previously known. The motion is so rapid that a single month suffices to give approximately correct values. Observations by Aitken, with the Lick 36-inch refractor, give an annual proper motion of 9.48 sec. The star has a decided orange color and is of about 10.5 magnitude.

The Companions of Polaris.—In addition to a ninth-magnitude companion, visible in telescopes of moderate power, the pole star has two close companions, beyond the range of telescopes, but known from the evidence of the spectroscope; one having a period of about four days and the other about 12 years. According to L. Courvisier, of the Berlin-Babelsberg Observatory, the visible companion also belongs to this multiple system, having a revolution period of at least 20,000 years.

Changes in a Nebula.—Mr. C. O. Lampland has applied the blink-microscope method to the study of a nebula (N. C. G. 6992), which has a structure so intricate and well defined that comparatively small changes should be susceptible of detection by this means. Two photographs, separated by an interval of about 14 years, were compared. Mr. Lampland reports that in the south part of the nebulosity there are apparently slight displacements of small portions of some of the filaments.

Studies of Planetary Nebulae were described by Dr. Heber D. Curtis at the last meeting of the Astronomical Society of the Pacific. Fifty of these nebulae have been studied photographically with the Crossley reflector, using different lengths of exposure, in order to bring out the structural details of the bright central portions as well as of the fainter outlying parts. Most planetary nebulae show a more or less regular ring or shell structure, generally with a central star. A paper by Messrs. Campbell and Moore, presented at the same meeting, gave the results of a search made with a spectograph and the Lick 36-inch telescope for rotation effects in 33 planetary nebulae. Definite evidence of rotation was found in 16 and suspected in five others.

The New Chabot Observatory.—The municipal observatory—a type of institution that ought to be more common—is exemplified by the Chabot Observatory, which was presented to the Board of Education of Oakland, Cal., in 1884 by Mr. Anthony Chabot, with the stipulation that it was to be forever free to the public and public schools. The original cost was about $15,000. With the growth of Oakland and the increasing use of electric lights the location of the observatory, in the heart of the city, became more and more unsatisfactory. A new site has now been found, in the suburbs, where permanently satisfactory conditions are assured. Moreover, the city has liberally provided a new 20-inch refractor, of Jena glass, at a cost of $19,000. Although the building is not finished, the new telescope is already in use.

Prices of Meteorites.—Dr. Geo. P. Merrill, writing in *Science*, complains of the way in which meteorites have been split up into bits for the sake of satisfying the desire of private collectors to secure fragments, however small, in order to increase the numerical strength of their collections. Thus one of the earliest known meteorites, that found in Ensisheim, Upper Alsace, in 1492, is represented in 66 collections. The result of this practise is that exorbitant prices are asked by dealers for meteoritic material in amounts sufficient for analysis and study. "A recent catalogue of a Philadelphia dealer advertises a perfectly commonplace type of meteoric stone at $5.00 a gram, the only possible excuse being that there was not much of it, and in falling it passed through the roof of a barn."

Wolf's Comet.—The comet discovered by Wolf, at Heidelberg, on April 27, 1916, presents several features of unusual interest. At discovery the comet was about 4.1 astronomical units distant from the earth and nearly 4.9 astronomical units (almost as distant as Jupiter) from the sun; distances greater than those of any other comet at the time of discovery. Messrs. Crawford and Alter, in a note on this subject, point out that "even Halley's comet, whose position for its last return was quite accurately known, was picked up on this return when a little over three astronomical units away. It was found eight months before its perihelion passage, while Wolf's comet, although unexpected, was discovered nearly fourteen months before it will come to perihelion." The comet has now passed into the twilight, but will probably be reobserved as a morning object in December. Its brightness should then increase rapidly, and it should be in a favorable position for observation throughout 1917, coming to opposition soon after perihelion passage, which occurs June 16, 1917. It will then probably be visible to the naked eye. In large telescopes the comet will probably be visible to the end of the year 1918.

Invention Notes

Steel-Lined Ingot Molds.—Longer life for the molds and purer metal in the ingot is claimed to result from the use of steel-lined ingot molds, for which a United States patent was recently granted to Harry E. Sheldon of Pittsburgh. The steel surface of the mold is recommended to be of the same carbon content as the molten steel to be cast in it, and the metal of the ingot is not contaminated by the impurities of the cast iron of the mold.

Rubber Cover for the Watch.—Among the rubber novelties recently introduced, is a watch protector which covers the case entirely except the dial. It is designed for the use of workmen principally and for those who are compelled to move around electrical machinery and it renders the mechanism proof against damage. The clinging quality of rubber makes it almost impossible for the timepiece thus protected to slip out of the pocket.

Paper Cones for Soda Fountain Use.—Among the latest sanitary devices is a paraffined-paper cone for use either as a glass or a dish for serving soda fountain trade. The cone is made in two types: the first, intended for soda or other beverage, is narrow and deep, while the second, intended for ice cream, is shallow and of a wider angle. Convenient holders are used in conjunction with the paper cones, and in every way the paper cones are as satisfactory as the glasses and dishes which they replace. The cones are only used once, hence every customer is assured of an absolutely clean container for his order.

For Testing the Strength of Floors and Walls.—A building inspector of Seattle, Wash., is the inventor of a device for testing floors, walls and columns to determine their safety and carrying strength. The "extensometer," as he calls it, is said to be so sensitive that it measures the ten-thousandth part of an inch. When a floor slab is loaded the under surface stretches and becomes longer while the upper surface becomes shorter by compression. By measuring the amount of change and taking into consideration the kind and quality of the material and the load, it is possible to figure out the safe carrying capacity of the building. The new device is particularly adapted for use on concrete structures, because in them the weak places are not otherwise easily discernible.

Wave Motors Drive a Ship.—A system of driving a vessel by means of wave motors is covered in a recent patent granted to Benjamin P. Roach of Berkeley, Cal., who proposes to make use of the motion of the waves as well as the rocking of the boat to store up the necessary power to drive the craft through the water. This accumulation of power is accomplished mainly by the means of a false bow pivoted to the main part of the ship's structure and a somewhat similar arrangement in the stern of the vessel. The bow and stern form loose portions which are actuated by every plunge of the vessel and with each movement of these parts air compressing pistons are operated and a quantity of compressed air is forced into tanks, and subsequently drawn upon for the propulsion of the vessel.

Small Commutators.—A patent granted to Edward F. Smith of Cincinnati, Ohio, discloses an ingenious method of constructing small commutators from round bar material. The first step is to form a cylindrical block of copper, with a central bore and countersunk recesses in its opposite flat sides. Radially arranged cuts are then made in the block, which extend in from the peripheral side toward the center bore. The cuts are of the same depth and terminate so as to leave an intact annular zone of metal around the bore. The block is then placed in a cylinder, and insulating compound is forced against the blank so as to penetrate into every recess. After cooling and becoming hard, the insulating compound is found to have not only insulated the bars formed by the cutting, but to act as a bond for the segments, after the intact annular zone of metal is bored out. The commutator thus formed is finished by using a bushing which forms its bearing.

Ring Around the Piling Kills Teredo.—An extremely novel method of attacking the teredo problem, which is a serious one to marine construction in many parts of this country, has just withstood a sixteen months' test on the pier of Long Beach, Cal. These little destroyers attach themselves to the piling or other woodwork standing in the water, at some point below the high tide mark and down to about two feet below low tide, and several days are necessary for them to effect an entrance into the fibre of the pile. The present invention takes advantage of this fact and the animal is killed by the action of a metal ring which is placed loosely around the pile after it has been driven. With the action of the water this ring automatically traverses the affected area, and the repeated blows of the ring against the pile are said to kill the teredo before it has the opportunity of entering the wood. The abrasion resulting from the movement of the ring is inconsiderable.

The Tell-Tale Fossil

Finger Posts on the Road to Oil and Mineral Deposits

By Annis Salisbury

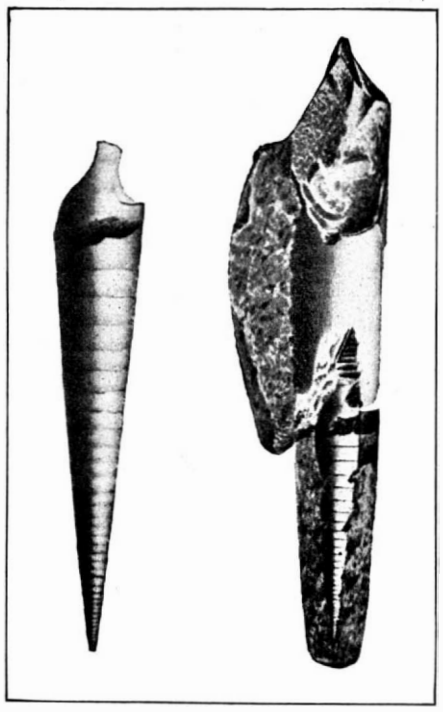
THE water witch must give way before the fossil seashell. The willow wand pointing with subtle magic to spot where may be tapped a clear vein of water, gold or reservoir of oil, is no longer needed, for the fossil sea shell Melania insculpta of Mesozoic age and the Echinodermata of Cambrian time unlock the secrets of the earth in a way that no other agency yet found has been able to duplicate.

Since 1859 geologists and well operators have been accumulating knowledge regarding the stratigraphic location of oil, gas, coal and water. Formation after formation has been added to the productive list until this now includes beds ranging in age from Cambrian to Quaternary. Reasons for their deposition are still in the haze of controversy, but enough practical information has been gathered regarding the occurrence of these substances to enable the economic geologist to know not only what stratum bears the mineral for which he is looking but its relation to other strata in the geologic column.

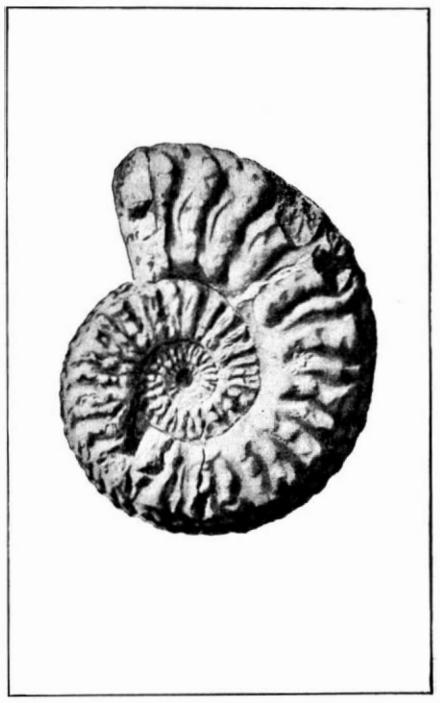
This is where the fossil mollusca and tiny crustacea preserved from the dim beginnings of time, are of incalculable value. Imbedded fossils are an infallible index to the age of strata, while lithological evidence frequently fails. If the oil driller or coal miner were to depend on rock testimony he might mistake a sandstone of Jurassic period for one of later incidence, and be led along a false scent to much useless drilling, or diverted from exploiting areas in reality productive. Fossil forms mark the progression from the earliest rocks with their extinct types of flora and fauna up to the latest petrified plant and animal forms similar to the life of to-day, and the assemblages of each epoch are readily differentiated from those of other epochs. The work of the mining engineer equipped with this shorthand to underground chronology has been greatly accelerated, and he has been put in possession of an open sesame to hidden stores of mineral wealth which without fossil criteria would never have been opened.

The most spectacular application of fossil lore to practical mining was the ferreting out of oil and gas pockets in the Coalinga and Midway Maricopa fields of California during the early California oil boom. A government geologist and paleontologist located well after well with almost uncanny precision. He showed such wonderful cleverness in correlating certain fossil data with the presence of oil and gas veins that he was finally persuaded to leave the government service, and to-day is reckoned one of the richest men of southern California.

Other fields followed in the wake of Coalinga, Geologists began to appreciate the significance of fossil remnants brought up in well cores and picked from the surface of the ground or from rock outcrop. They learned what forms were distinctive of oil-bearing strata, and familiarized themselves with the fauna of associated formations so that by drilling 50 or 100 feet they could predict the strata hundreds of feet deeper. The exploitation of oil and gas by the flash of the fossil mollusk spread from southern California into Texas and Louisiana. A school-teacher who had made a fad of fossil research discovered the first gusher in Texas. The Petrolia field followed, with the oil area mapped out on a basis of fossil data. A type fossil discovered in a water well in Louisiana incited experimental drillings which led to that cluster of Gulf wells of which Spindletop with its 70,000 barrels a day was the crowning glory. The petroleum output of the United States was more than doubled by the coming in of these southwestern fields, and a large share of the credit may be given without quibble to the seemingly innocuous and useless fossil vestige.



Upper Triassic shells of the California oil fields

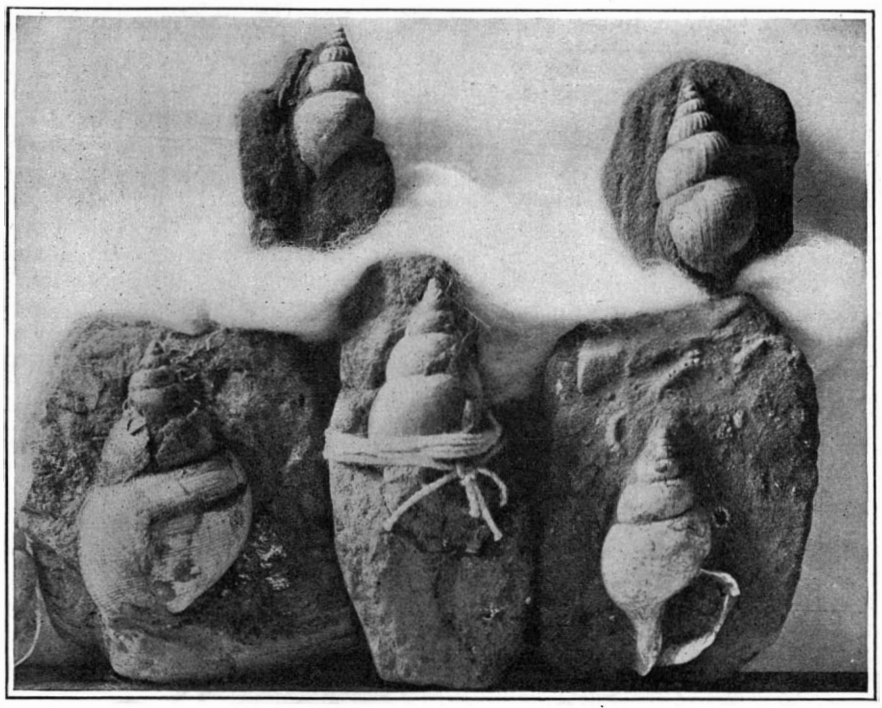


Meekoceras, a constant adjunct of phosphate beds

The practical application of fossil criteria to the exploitation of new oil areas in Oklahoma, Kansas and Arizona is in the making. Fossils from a region far dissociated to the laymen with oil and gas resources show a correlation with regions of recognized mineral wealth. Enthusiastic investigators are confident of working out in great degree the puzzle of the earth's mineral constituencies through the use of the fossil key. The science is still formative, but reports hint at ever greater usefulness from the fossil shell or the fragment of fig leaf imbedded in Cretaceous rock.

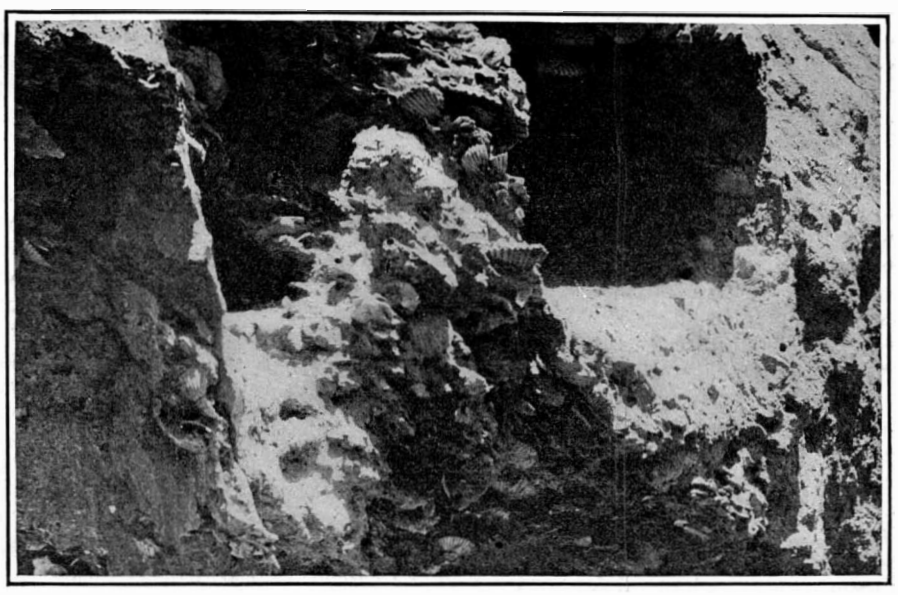
But not alone in the location of oil does the fossil shell play a part. Underground water, though popular idea associates it with subterranean lake or river, follows as definite strata as oil or gas, and has as definite geologic relations. Its typical occurrence is in a porous sheet of sandstone, overlain by clay shales or limestone, sloping into a shallow basin or dipping gently in one direction. To locate a well at a point over this sandstone layer which will give sufficient head for the water to reach the surface, is the problem of the well-driller. Fossil criteria procured at outcrops of these or associated formations not only indicate a possible well-head at a definite distance, but frequently warn against drillings that will be hopeless because of the depth or the resistance of the intermediate formations.

The Geological Survey has made a comprehensive study of the subterranean water of the Atlantic coast and the Gulf embayment. Canning factories, laundries, ice-plants and other concerns requiring an abundant supply of water make use of the scientific aid thus provided. The South Dakota ranchman sends in samples of fossils and procures definite advice as to the advisability of sinking a well in particular formations. The hotel keeper at Atlantic City who wishes to install an artesian well keeps close watch for forma-



Cretaceous conch shells which afford a geologic key to the western coal fields

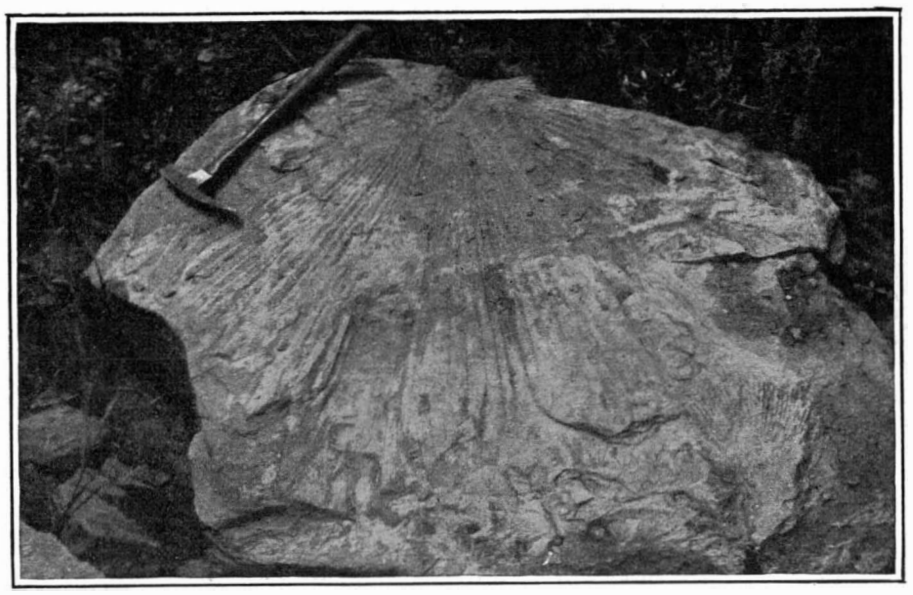
Uncovering fossil remains in the search for mineral deposits



Beds of fossil mollusks that play an important part in locating California oil pools

tions associated with the water-bearing Miocene sands of that region. Norfolk, Richmond, Atlanta, and many other southern and middle western cities have secured the coöperation of federal geologists in the location of underground strata which would be a satisfactory and unfailing source of water supply. So the fossil mollusk *Inoceramus* or its distant relative *Corbula ungera* of many thousand years ago plays its part in the affairs of every resident of this broad land who is in any way dependent upon underground sources of water supply.

Again, fossil vestige is instrumental in the recovery of valuable coals which otherwise would have been unmined. The testimony of a fossil tooth led to the recent reopening of a long abandoned mine at Carthage, New Mexico, making available millions of tons of valuable coals which would otherwise never have been touched. The largest coal field of France owes its existence to fossil relics. In the Grand Combe region, abandoned years before as fully worked out, a paleontologist found minute *Echinodermata* which hinted at possible readjustments in geologic mapping. The drill was sunk to what seemed to skeptical engineers unfathomable depths, but scientists urged on the work, and beds of original carbon were finally reached which formed the main coal deposits for France for years thereafter.



Fossil palm leaf, a guide post to extensive bituminous deposits

The coal miner of to-day finds *Halymenites major* and *Corbula undifera* eminently useful in indicating beds not predicted by evidences in the stratum outcrop. Halymenites, a fossil algae, is found in the Rollins sandstone, immediately below the lowest coal-bed, and is associated with high-grade bituminous coal. *Geonimetes ungeri*, a palm recognized by its corrugated surface, accompanies a vein of low-grade bituminous. Definite fossils are coming into general use in specific regions as indices to certain kinds of coal deposits.

Other instances of the value of the fossil mollusk are reported daily. The phosphate miner in Idaho has come to look for the fossil Meekoceras with which phosphate rocks are associated. This type is found in the Anhareb formation lying 1,200 feet above the phosphate bearing rock. Prospectors in Kentucky associate another type of fossil with phosphate deposits. In Ozark, Missouri, a strong probability of unworked deposits of zinc, indicated by the fossil content of the blue shale underlying this whole region, was verified by subsequent mining. In the Bannock region of Idaho, fossils indicated foldings in the underlying structure which extended the workable phosphate vein for 35 miles.

Scarcely two generations have passed since the science of paleontology had its beginning. The most weird and fantastic theories were advanced by the people of the 16th and 17th centuries to account for the petrified objects discoverable in the earth. With the 18th century came the theory that all fossils were the debris of the antediluvian life of the globe. Though tremendous effort was exerted to make accumulating facts support this theory—even to the extent of supposing the waters to have reduced the rocks of the earth's surface to a pasty mass into which these organic fragments had sunk—it finally broke down, and was supplanted by recognition that fossil assemblages are characteristic of certain formations. With the acceptance of stratigraphy, geology took a leap forward. Puzzling formations which had baffled geologists for years were deciphered by means of the fossil key. Of greater interest, however, than settling the academic query as to whether a rock is Cambrian or Carboniferous is the practical use of the fossil guide in uncovering extensive and valuable deposits of copper and coal.

Tons of fossils are yearly sent in to the National Museum where expert scientists identify and classify them. The Eocene is separated from the Miocene and species and sub-species divided out from larger divisions. While to the uninitiated this might seem the very quintessence of scientific fervor, the data being daily hammered out regarding Meekoceras and Astrodapsis enable the driller for water to know 50 feet sooner than otherwise whether he may or may not hit the water horizon, or the miner for phosphate to dig through a lesser number of strata before striking the fossil which identifies the ore he seeks.

Few abstract scientific undertakings can be found possessing such immediate and appealing applications.

Utilization of Old Railroad Ties

By R. P. Crawford

THE old railroad tie, turned black with eight to twelve years of service, is coming into its own. Substantial savings are being effected by the Burlington railroad by concentrating these ties at division points, where huge wood yards are maintained. When cut into arm lengths in a specially devised machine it has been found that they form the best kind of wood available for starting fires in locomotives.

A few years ago the ties, after they had completed their term of service, were burned along the right-of-way, given to people living nearby, or otherwise got rid of. At the same time the railroad was spending large sums of money buying kindling wood for its locomotives.

The tie splitting camps are isolated from the main railroad shops for fire protection. Piles of ties waiting to be cut up are several blocks long. The ties are transported to the tie splitter over a little stub line of railroad a couple of blocks long. Cars are placed on another track by the side of the tie splitting machine and the wood is loaded directly onto them as the ties are cut up. Old box cars that formerly were burned to get at the metal also find their way to the wood yard and are cut up for kindling wood.

A device working on the principle of a steam hammer but using compressed air as motive power, breaks the ties up into four pieces. A knife, resembling a huge spike, is raised to a height of 6 to 8 feet and then allowed to descend with its full weight, at one blow cutting the tie in two pieces lengthwise. The tie is turned a trifle and the second blow severs it across the middle. The ties, having been cut into four pieces, are loaded into cars for shipment to different points on the division as there is call for wood.

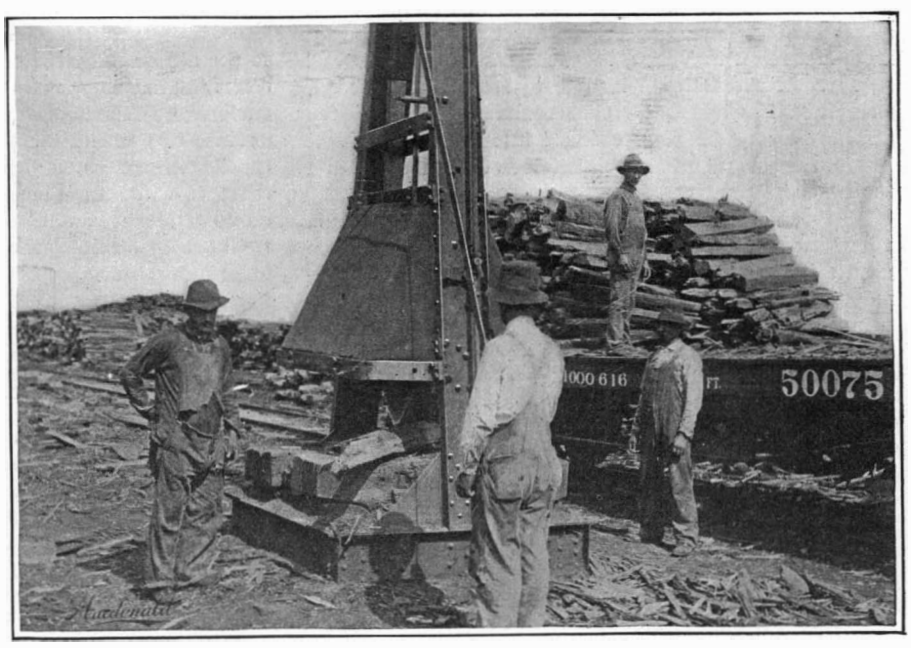
Ties usually last from eight to twelve years. It is estimated that on the Burlington lines west of the Missouri river alone 1,267,200 ties are replaced every year. On the sidings 290,400 ties formerly were going to waste. The old ties, it has been discovered, are invariably well seasoned, and the necessity is thus done away with for storing kindling wood until it is in a fit condition to be used.

Formerly burned to get rid of them, this mass of ties is now put to useful purpose

A New Type of Landing Gear

A NEW type of combined land and water chassis has been invented by Lieut. Angström of the Swedish Flying Corps. As reported in *Aviation*, it consists of two floats attached to the chassis, one on either side, and to each float is rigidly secured the axle of a wheel, the wheel projecting over the inner edge of the float for nearly half its diameter. The floats are so hinged as to turn in an angle of 90 deg. When adjusted for hydroplaning, the floats are hung so that the wheels are in a horizontal position, with only a portion of each wheel projecting beyond the inner side of each float.

Bringing the ties to the cutter



Making cord-wood of old ties

Strategic Moves of the War, October 4th, 1916

By Our Military Expert

A FEW weeks since had the average casual reader of newspaperdom been asked where the Dobrudja was, he might have replied facetiously that the last time he saw it, it was in the upper left hand corner of the bottom bureau drawer; in other words, few had ever heard of the place. But with the developments of recent weeks this obscure province has leaped into prominence and seems likely to become even better known.

A good many sound military strategists shook their heads in doubt when von Mackensen drove his forces headlong into this country which lies, funnel-like, between the eastern reaches of the Danube and the Black Sea. It was outside Roumania's strong geographical line of defense, and at the neck of the funnel there lies a tempting prize, the railway from Constanzia to Bucharest, Roumania's sole communication way with Russia via the Black Sea. The German general might well make a hasty and strong thrust for the point, providing that troop combinations of his enemies be not too speedily effected; for otherwise, Mackensen's rear and communications would be dangerously exposed in the event of a Russo-Roumanian crossing of the Danube in force.

And this is just exactly what has happened. Such a force has crossed the Danube into Bulgaria at some point between Rustchuk and Tutrakan and is now reported to be fortifying the bridgehead as an initial advanced base before proceeding with the attack. At the time of going to press the strength of this force is not known; but it seems very reasonable to assume that, whether it be large or small, in any event it is but the advanced element of an ample force. There is a physical limit to the number of men who can effect a crossing by way of pontoon bridges, few in number, in a day. And it is equally reasonable to hold the opinion that at this stage of war-knowledge, neither Teuton nor Ally is throwing away men without reason. The crossing point is open to attack from two sides and in front, for Tutrakan and Rustchuk are both garrisoned towns and the Teutonic reserves must be located rather centrally with relation to the Constanzia-Bucharest line and the place of the Roumanian crossing of the Danube. Therefore it is believed that the Russo-Roumanian plans for a stroke against Bulgaria are practically complete, that a powerful force is streaming across the Danube somewhere east of Rustchuk, with the prime objective of cutting of the Teuton forces operating in the Dobrudja, the secondary of thrusting through Bulgaria in combination with Sarrail's northward attack from Macedonia.

But even supposing a greatly superior Entente force gets a firm foothold on the south bank of the Danube and moves forward, Field Marshal von Mackensen is not necessarily exposed to annihilation; about the worst that can happen to his force is to be compelled to retire before too late, for Mackensen's line of retreat is backboned by the Varna railway, which lies far enough away from the Danube for it to be adequately covered by flank guard, even to the strength of the majority of his force. The broken country, swampy at best, now reported as a quagmire on account of torrential rains, lends itself admirably to defense and offers a difficult problem to any force seeking to advance over that land where roads are to be found only now and then.

It is more than likely that when the Russo-Roumanian force is ready to move, it will not be eastward or southeastward; far more likely it will strike to the south and southwest in the effort to cut the railway from Rustchuk to Varna, Mackensen's tortuous line of supply. If the Entente is able to reach the railroad, then indeed will the German commander be in dire straits, for it will resolve itself into a race for Yeni Bazar, the sole junction point between the Dobrudja and the heart of Bulgaria.

If, threatened in rear and on the flank, Mackensen withdraws from the Dobrudja while the Allies make good a hold upon the Rustchuk road, the German commander may extricate his guns and supplies and maintain his supply service of ammunition, food, etc., only while the Yeni Bazar junction is clear and open.

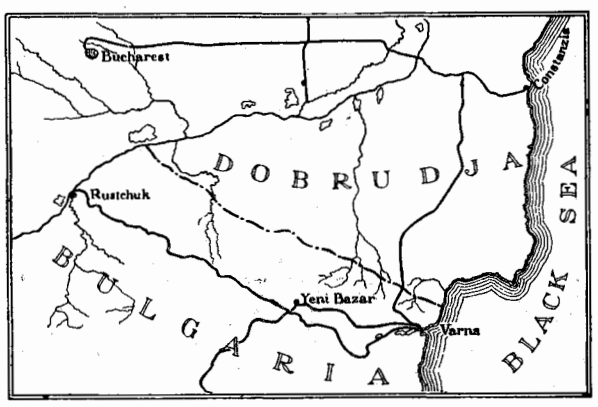
As anticipated, it seems clearer every day that the Roumanian operations in Transylvania are but holding ones. The troops on duty there are ready to take over any ground which the Austrians may be willing to concede in straightening their lines, but there appears to be no indication of an attack being launched against Hungary in the near future; and all this but lends significance to the operations brewing elsewhere.

Roumania must have at least 200,000 men available for use in the stroke against Bulgaria; Russia has probably as many more already on the ground. It is believed that at least 400,000 Allies are available for the direct attacking force, the principal massing being in the neighborhood of the recent crossing.

What can Teutonia oppose to this force? Recalling the fact that there are at least 600,000 Allies on the Macedonian front to be faced, Bulgaria can scarcely spare more than 100,000 men for her northern boundary operations. Perhaps Austria and Germany have added another 100,000, while Turkey may, by some stretch of imagination add a third 100,000; 300,000 in all, distributed from end to end of the frontier, massed principally now in the Dobrudja and in strategic positions somewhere in reserve. This makes the tally in the proportion of 3 to 4, giving the Entente a 25 per cent advantage in numbers—providing the estimate (which it is, pure and simple) is anywhere near accurate.

It looks very much as though the division of force which now exists must be almost a final one, in positions and situations which must be fought out as they stand, for Bulgaria possesses no lacework of railways over which troop-masses may be shifted from front to front at will. By rail the shortest distance from Rustchuk, on the north, to the closest point on the Struma battlefront is about 400 miles by way of Philippopolis and Adrianople, and over a single line. This does not promise much in the way of shuttling forces.

Very slowly the Macedonian lines are being extended northward. The English have pushed east of the Struma, the Serbians have gained a little more ground in the direction of Monastir, the center seems inactive, as though waiting for a situation to ripen. In all, 600,000 men, to be augmented by a possible 300,000—call it 200,000—Grecian troops within a reasonably short



Where Roumania is fighting Bulgaria

time, are beginning to move northward. And what force confronts them?

Perhaps 200,000 Bulgarians, 100,000 Turkish, 100,000 Germans and Austro-Hungarians—about 400,000 in all. With the advantage of interior lines—such as they are—Teutonia can muster on or near the borders of Bulgaria 700,000 men. And against these the Entente has at least 1,000,000, not including any Greek contingent. It is true that these Teutonic forces can be augmented by troops sent in from Turkey and the defenses of Constantinople and by divisions from Teutonia proper, via Belgrade and Nish; but as surely as such troops are fed in by these routes, they will have come from all important general reserves. The Entente Allies are seeing to it that Balkan reinforcement does not come from the battle lines.

There is reasonable probability that Turkey will send to the aid of Bulgaria every man she can spare, for in effect the battles which are being waged to-day on Bulgarian and Roumanian soil are properly part of the defense of Constantinople. Turkey knows well that if the Entente clips her from her Teutonic communications, it will soon thereafter become necessary to undergo a siege at ancient Byzantium; it is therefore the part of discretion for Turkey to give every ounce of aid now, in hopes of preventing a successful grinding of the upper and nether millstones of the Entente to her destruction.

Again the Russians in Volhynia, Galicia and Bukovina are showing activity. This becomes of moment when it is considered in the light of recent Roumanian demonstrations. Weakened as she is, Austria would nevertheless try to move troops from the Russian front to use against Roumania—and Sarrail—if Russia would permit. But it seems that Russia will not.

On every front, then, the Entente is battling, striving for local success, but striving more to hold everything in place while a massing is made against a given objective. It cannot be stated with definite assurance that Bulgaria is the objective in question; a great attack may develop almost anywhere, but by putting two and two together again and again, and by watching the blowing straws—and adding them, too—it is the belief of the writer that the big thrust against Bulgaria has begun and that the next three weeks will witness developments of tremendous importance in the world war.

Iodine as a Military Antiseptic

THE use of iodine as an antiseptic has been meeting with much favor within a recent period, and in Europe it is coming into extensive use in the army. Tincture of iodine is the form which is usually employed, but an excellent solution and one that has a number of advantages is alkaline iodized hydroxyl, made up on the following formula: Iodine of sodium three parts, hydroxyl (12 volume strength) 100 parts, distilled water 100 parts. This solution should be freshly prepared for use. It has the advantage of not only acting at the surface like simple antiseptics, but as the oxygen begins to act upon the albuminoids in increasing degree, the iodine is at the same time fixed upon the tissues and this very intimately. Here the iodine is not in the state of simple solution, but takes the form of a chemical combination of a colloidal nature. This antiseptic is also found to be a very good deodorizer for surgical and other use, and it clears the atmosphere of bad odors coming from wounds.

The extensive use of this solution as an antiseptic for army use has led to a search for the most practical methods of applying it. The main point is ability to apply a small quantity of the tincture to wounds—even by a soldier himself when on the field—without wasting this expensive substance. One method is to combine the tincture with white soap and flow into a lead tube of large diameter, where the substance becomes solidified or jelly-like. But there has previously been inserted a wad of cotton in and below the neck of the tube, thus separating the tube opening from the substance. Pressing on the tube in the usual way, the iodine is expelled from the jelly and goes through the cotton to the mouth of the tube, and thus a small portion can be squeezed out at a time. In reality the composition is made by dissolving the soap in alcohol and then adding the iodine. A paraffin lining protects the metal of the tube.

Another method consists in making up a soldier's tube for personal use which contains just enough tincture of iodine for a single application. Take a tube of 2 or 3 inches length, the liquid being placed inside and the end of the tube closed off by fusing in the usual way. Beforehand there are fused two grooves around the tube on each side of the middle, and a cotton pad is put on here by placing cotton around the middle and covering with cloth, each end of which is then tied into the grooves by string. A scratch has also been cut upon the glass by a file around the middle of the tube. To use, break the tube at the middle upon the scratch, and the iodine runs out into the cotton wad which absorbs the whole of it, then apply to the wound. In this way none of the liquid is wasted, as is invariably the case when iodine is used from a bottle.

The Current Supplement

AN article of particular interest in the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT, No. 2128, for October 14th, is *Astronomy in 1915*, which is a review of the subject by a French authority, written in a style that will be found acceptable by every reader. *The Making of a Photographic Objective* describes a course in applied optics, and covers matter that will be found of value by everyone who has to do with photography in its more serious phases. The paper is accompanied by a number of illustrations. *Notes on Carburetion* covers a subject that will appeal to most everyone, especially as the author considers some matters relating to the use of heavy fuels. *Melting Down Foreign Gold* tells what becomes of the great quantities of foreign coin that are coming into this country, and several excellent pictures add to the story. *The Cultivation of Peanuts* gives much information and several pictures relating to a valuable crop, the products of which we are all familiar with. *The Naval Reserve Force* gives the portion of a bill, recently approved by Congress, which establishes the new citizens organization that has aroused such universal interest. *The Evolution of Big Guns* covers a timely subject, from the old cast iron smooth-bore cannon to the modern built-up breech loader, and is illustrated by useful diagrams. *Good Lighting* gives some of the fundamental principles and modern practice of an important subject. There are also a number of shorter articles of general interest.

Bed-Rock Legislation for Preparedness

What the Engineers Have Brought About and What is Needed for To-morrow's Task

By Malcolm MacLaren

THE movement toward national preparedness in America which started with the outbreak of the European war has made a distinct advance through the legislation which has taken place during the summer—legislation which the organized work of the Nation's engineers has admittedly done much to procure. Two laws, in particular, have been enacted which should go a long way in enabling this country to put itself into a state of adequate defense. One of the most significant facts connected with these acts is that they make a direct appeal to the engineering and industrial leaders of the country to coöperate with the Government in this movement in a truly patriotic and non-partisan manner.

In the first of these acts, the Army Reorganization Bill, in addition to providing for army reserve corps and a nitrate supply, the Secretary of War is instructed to obtain a complete list of all privately owned plants in the United States equipped to manufacture arms or ammunition, and complete information upon the maximum output and kind of arms or ammunition that can be manufactured in each plant. He shall also obtain a list of plants capable of being readily transformed into ammunition factories and shall prepare comprehensive plans for transforming each such plant into a factory in which the manufacture of ammunition or parts of ammunition as in the opinion of the Secretary of War such plant is best adapted. Also, the President is authorized, at his discretion, to appoint a Board of Mobilization of Industries Essential for Military Preparedness, which shall be non-partisan in character and which shall organize and coördinate the work described above.

The Secretary of War is also instructed to prepare or purchase such dies, gages, jigs and other appliances including specifications and detailed drawings as may be necessary for the immediate manufacture, by the Government and by private firms, of all material necessary to arm and equip the land forces likely to be required in time of war.

The Council of National Defense

By the second act, the Army Appropriation Bill, a Council of National Defense was established, to consist of the Secretary of War, Secretary of the Navy, Secretary of the Interior, Secretary of Agriculture, Secretary of Commerce and Secretary of Labor. This Council shall have the assistance of an advisory commission, appointed by the President, composed of not more than seven members.

Three great problems are placed before the Council by this bill:

(1) The coördination of all forms of inland transportation to meet the military needs of the country.

(2) The development of seagoing transportation.

(3) The readjustment of our industries to meet the military requirements of the Nation in time of war.

The first problem involves a study of the location of our railroads with reference to the frontiers of the United States so as to render possible expeditious concentration of troops and supplies at points of possible defense; also the utilization of inland waterways, highways and branch railroads for military and commercial purposes. Much work has already been accomplished along these lines and undoubtedly most of the data required for further development of this plan is already in the hands of the Government.

The scope of the second problem is not defined in the bill, but it gives authority to this non-partisan body to make a thorough investigation of the development of our mercantile marine service.

The third problem involves taking measures for the increase of domestic production of articles essential to the country in time of war which are now largely imported, and establishing closer working relations between the Government and manufacturers in order that the industrial plants of the country should be available for furnishing an adequate supply of all forms of munitions and supplies to the army in case of war. To accomplish these results the necessary tools, specifications and drawings must be prepared and distributed among accredited firms together with annual trial orders, which will enable these plants to turn immediately to the manufacture of munitions in time of emergency. The carrying out of this part of the Government's program must be over practically untried ground except as it continues the work of the Naval Consulting Board's Committee on Industrial Preparedness, and one of the first steps might be to extend the scope of the industrial inventory which has been already so efficiently undertaken by this committee.

A Few Vital Conclusions

The detailed reports which are now on the hands of the committee should be of great value to the Council

THE author of the following article is professor of electrical engineering at Princeton University, and, as expert adviser, has been closely associated with the far-reaching work of the Committee on Industrial Preparedness of the Naval Consulting Board to mobilize American industry for the uses of the American armed forces in time of war.—EDITOR.

in suggesting lines of approach and indicating some of the subsidiary problems which require consideration. Upon looking over these reports one cannot help being struck with the great number and wide distribution of the firms now temporarily engaged in the manufacture of munitions. It is obvious that the experience gained in this work should be made available for this Government to the fullest possible extent and that the tools and equipment now in use should be reserved, in so far as possible, for our own needs after the present war orders cease. The creation of an industrial reserve should also be considered in this connection in order that the skilled labor engaged in this work should be rendered available in time of need. Many firms which

A poster of the Committee on Industrial Preparedness

Design painted by Milton Herbert Bancroft and presented by him to the Committee on Industrial Preparedness of the Naval Consulting Board of the United States for use in its Nation-wide campaign to mobilize the industrial resources of America for the Government's use in time of war

have executed contracts with our Government report that they consider the Government's specifications too severe and the inspectors too strict and arbitrary in their rejection of material. These cases might be investigated in order to reëstablish cordial relations and to determine the validity of their claims in the light of the work being carried out for other governments.

Before distributing tools and manufacturing data and placing trial munition orders it would be desirable to determine from these industrial inventories the present capacity of all plants now making munitions; then to determine the probable additional supply which would be necessary in time of war and to consider what classes of factories could be most readily transformed for producing such material and the extent to which such conversion could be effected without curtailing the output of other necessary military supplies.

It is the purpose of this legislation to create a new organization to carry out this whole program and the details of the plan have been in the process of evolution during this session of Congress. It would seem that the enactment of the Army Appropriation Bill would largely supersede the industrial preparedness program contained in the earlier Army Reorganization Bill, and that now the Secretary of War would naturally turn to the Council of National Defense, of which he is a member, for the preparation of plans and equipment required for the manufacture of munitions. The creation of the Board on Mobilization of Industries Essential for Military Preparedness, which was to be appointed at the discretion of the President, would, therefore, be superfluous, and the entire responsibility for industrial preparedness would be in the hands of the Council of National Defense.

A Look Into the Future

The writer is not familiar with the plans which the Council may have formulated for carrying out this program, but it would seem to him that the permanent organization required to assist the Council and the advisory commission might readily follow the same general lines as those employed by industrial concerns which have a central organization containing the administrative and executive departments, but which deal with their customer through district offices. In this case the natural division of districts would follow state lines. If this plan were adopted the 250 state directors of the Committee on Industrial Preparedness might be appointed as state representatives of the Council, thereby obtaining at once the services of a well organized body of men, members in high standing of five great national engineering societies, especially qualified for their duties through their work during the summer. The function of the state boards would be to keep the Council posted upon the industrial and natural resources of their state, to carry on all correspondence between the Government and the recipients of trial orders, and in general act as the Government's local representative in all matters pertaining to national defense. A movement has already been started among some of the leading engineers of the country to organize these state committees into a permanent body and this would be one definite service they might undertake.

In addition to the state boards, the Council would undoubtedly require the services of highly specialized experts along various lines if the problems outlined above are to receive adequate consideration, and the Army Appropriation Bill provides for the appointment of these experts. Committees of these specialists might be formed to make recommendations to the Council upon the following subjects:

Inland Transportation.
Seagoing Transportation.
Development of New Industries.
Coördination of Existing Industries.

For the Myriad Uses of Modern War

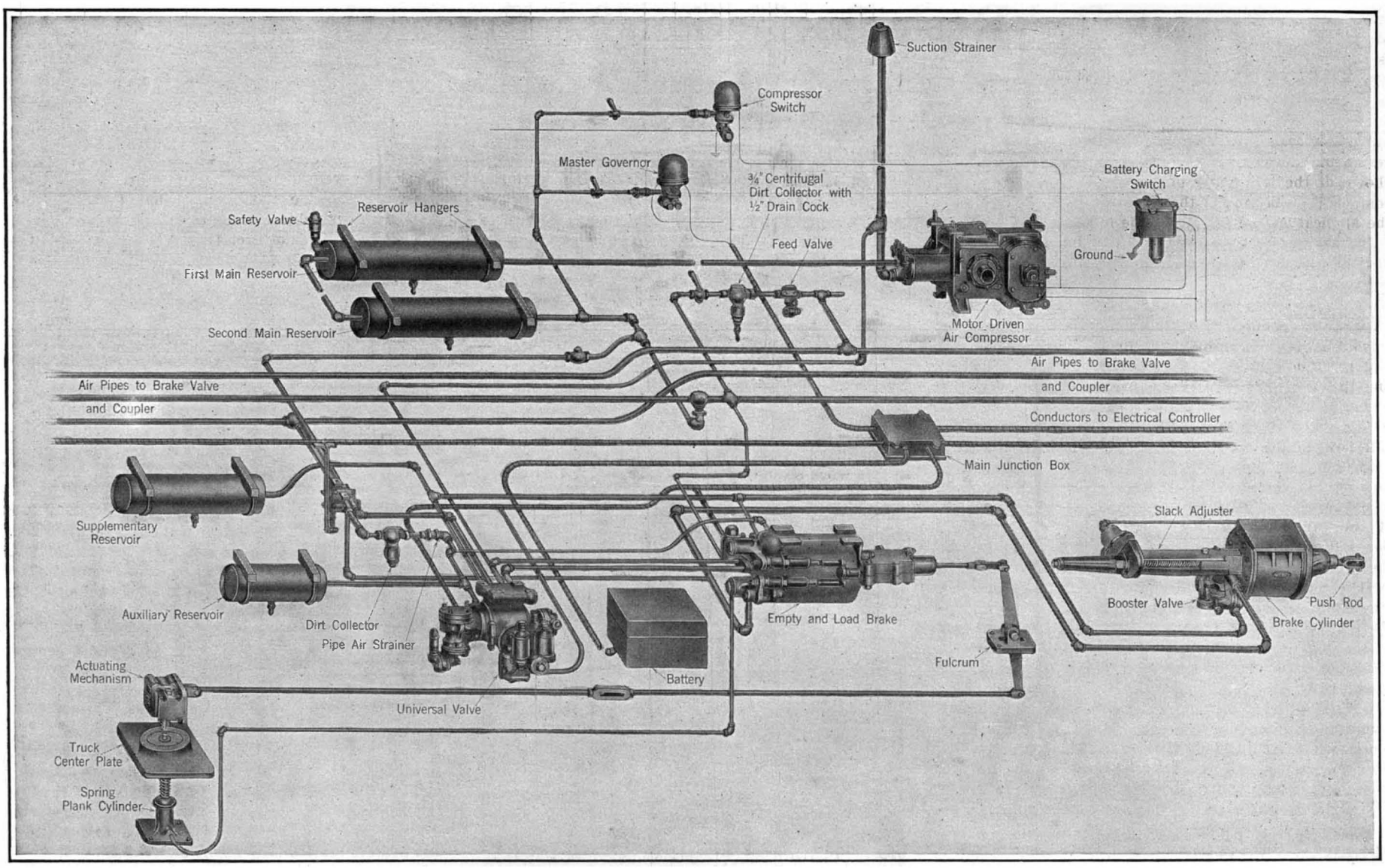
All of these committees could be small except the one on Coördination of Existing Industries, which would have to consider the possible requirements of the army in time of war for all forms of munitions and supplies, the preparation of tools and equipment for the manufacture of munitions, the distribution of trial orders and the preparation of plans for transforming certain plants into munition factories. Possibly, it would be necessary to subdivide this committee into groups of specialists in certain lines of industry, which might be classified as follows:

Ammunition and Explosives.
Guns, Gun Carriages, Caissons and Accessories.
Personal and Horse Equipment.
Machine Tools, Dies, Gages and Fittings.
Food.
Clothing.
Medical and Surgical Supplies.
Aeroplanes and Balloons.
Chemicals and Oils.
Electrical, Optical and Lighting Equipment.
Camp and Sanitary Equipment.
Transportation.
Engineering and Construction Supplies.
Ships and Marine Equipment.

After the initial problems connected with this undertaking have been thoroughly worked out, it would be seldom necessary to consult this body of specialists and they need not form part of the permanent organization of the Council. It does seem, however, as though the functions of this body might be enlarged so that the technical brains of the country might be banded together into a purely non-partisan organization which would stand ready to assist the Government not only in matters pertaining to defense, but also in the broader work of developing all of our national resources.

A Biological Station on Lake Baikal

WITH the aid of a fund presented by a Siberian gentleman, the Imperial Academy of Sciences, of Petrograd, is planning to establish a biological station on the shore of Lake Baikal. This lake, which in places is more than a mile deep, has a remarkable fauna, some of its fishes not being found anywhere else in the world. Some of the species are very ancient, and are supposed to be vestiges of the subtropical fauna which existed in Siberia in the Upper Tertiary period.



Arrangement and relationships of the different members of the braking system on the new New York Subways

How the Passengers Regulate the Subway Brakes

Changes in Car's Weight Made to Control the Amount of Power Applied to the Shoes

By Herbert T. Wade

THE part played by the air brake in passenger service where there is considerable density of traffic is not always realized, nor is the fact appreciated that only by the development of braking systems increasingly more efficient can the vast volume of traffic on such busy lines as the New York subways be handled. The stopping of the trains quickly, effectively, accurately and without discomfort to passengers, and absolute control by the motorman irrespective of automatic stop devices, are indeed features of paramount importance, for they condition the number of high speed trains that can be safely operated in a given time over a definite amount of track. More than once during the brief existence of the present subway there has been necessary a complete reorganization of the braking equipment to secure increased efficiency and safety.

The experience thus gained is being put to good use in the plans of the New York Municipal Railway. Starting as it does with a full equipment of absolutely new cars, this organization is able to employ new types and appliances and to avail itself of the latest improvements in every detail, without the embarrassing necessity of considering the effect of such items upon existing equipment. Nowhere has this advantage been put to better use than in connection with the braking system. In the new subways, trains must be operated at a scheduled rate per hour of 15 miles for local and 25 miles for express service, with average station stops of 20 and 30 seconds, respectively. From an initial velocity of 50 miles per hour, the retardation for an ordinary service stop must be not less than 2 miles per hour per second, and for an emergency stop at least 3 miles per hour per second.

The braking power to be exerted upon a train or car depends obviously upon its weight, which varies with the number of passengers. A constant braking power might, where the load was light, produce so tight an adhesion between brake-shoes and wheels as to cause disastrous wheel sliding; and on the other hand, with a fully loaded car it might be inadequate to effect as rapid a stop as desired, eventually leading to accident.

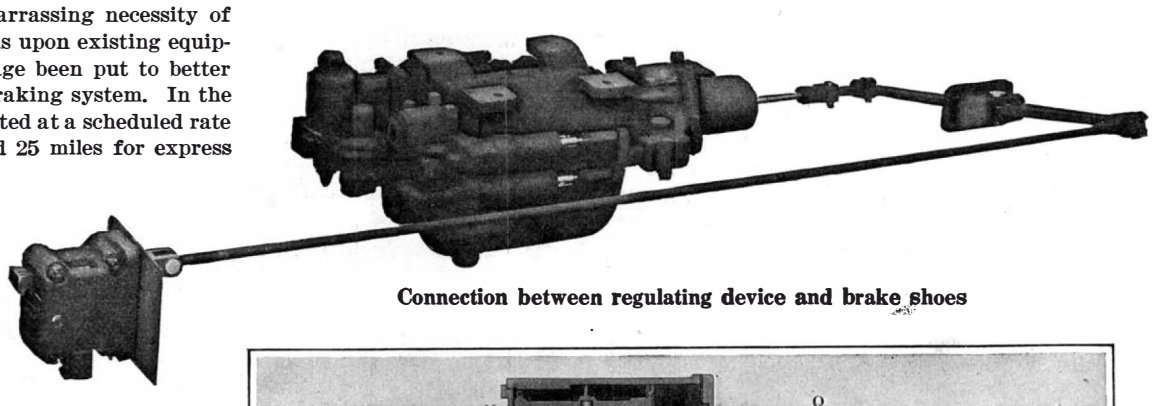
Underlying all attempts to meet the conditions here outlined is the electro-pneumatic air brake. Fundamentally the air brake consists of a cylinder with piston connected to a push rod which, through a lever system of intermediate rigging, applies the braking force to the shoes. In the case of the subway cars and of modern high speed trains generally, there are two shoes to each wheel, the action involving what is known as the clasp principle. On applying the brakes, valve action is set up to exhaust the air on one side of the piston, so that the pressure on the other side becomes preponderating and accomplishes the desired work.

Where the control was purely pneumatic there was apt to be delay and uncertainty in the application of the brakes throughout the train. The present standard electric control system resolved this difficulty, but there still remained the question of variable load. This of course affects the entire operation of the brakes, and may vary within considerable limits in a single trip. Particularly does this problem present itself in the case of the modern light weight steel cars used in electric trains. Thus the cars to be used in the newest of the New York subways weigh when empty but 85,000 pounds, and when loaded have this weight increased by 38,000 pounds, or 45 per cent. Such an addition of weight must naturally lengthen the stopping distance unless added and adjustable braking power is made available.

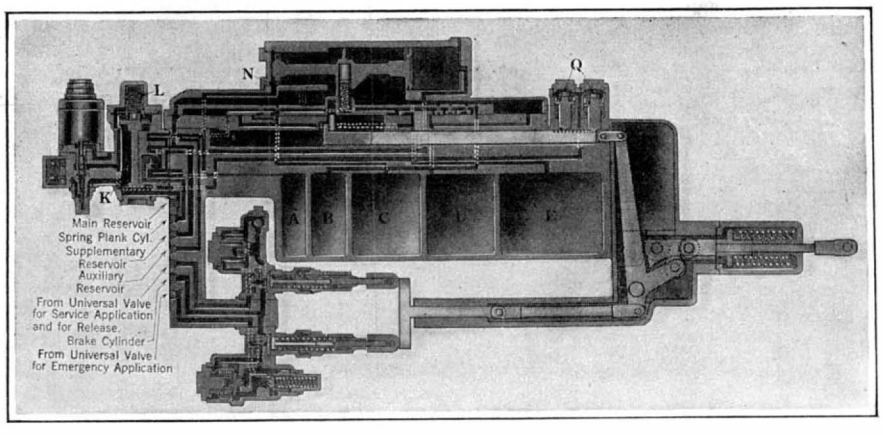
This has been effected in a most satisfactory manner by varying the effective volume of the air which acts upon the brake cylinder, so that this volume depends upon the conditions of service—that is, upon the number of passengers. The controlling factor is the vertical movement of the car body relative to the trucks. An auxiliary air reservoir is provided, partitioned into a number of compartments of different sizes, whose communication with the main air reservoir through a series of ports is controlled by a slide valve. The movement of this valve is actuated by a pin connected with the piston of a small air cylinder carried in the springs of the car, and moving up and down when the bolster is depressed or raised under the change of load as passengers leave or enter the car. Thus the weight of the car automatically adjusts the auxiliary reservoir capacity of the braking mechanism so that it will function according to the duty required; and each passenger contributes his share toward giving the increased power demanded by the weight which he adds.

It is of course necessary that the adjustment operate only when the car doors are open, so that when the train is in motion there shall be no change in the braking power from the movements of the car-body caused by inequalities in the road-bed. This condition is met by an automatic lock which fixes the controlling slide-valve fast in place as soon as the doors are closed. While the train is in motion there is therefore no connection between the load-measuring mechanism and the braking apparatus.

The operation of the new device can be best appreciated by reference to the accompanying diagrams. The large view shows the general assembly of the various elements entering, and their mutual relations. The compressed air is furnished by a motor-driven compressor supplied with a governor which starts and stops the motor automatically and maintains the air pressure in the main reservoirs within



Connection between regulating device and brake shoes



The regulating chamber which applies the weight of the car to the brake valves

the limits pre-determined. There is a supplementary reservoir from which air is supplied after the brake is exhausted. The air used in the adjustment process is contained in the auxiliary chamber, which is in connection through the valves in the empty and load brake regulating device. The universal valve, shown at the left center of the diagram, controls the charging of the reservoir and the application and release of the brakes.

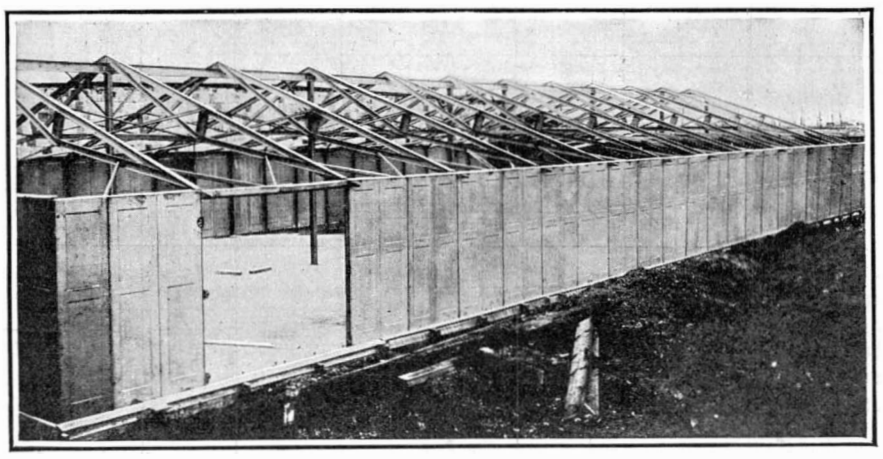
In the smaller diagram the regulating device is shown in section, in the empty position with the car doors closed. Air from the main reservoir enters the valve at the pipe connection and flows to the regulator-valve slide-valve chamber (K) and through to the latch cylinders (Q), one of which will, as shown, be in mesh with the notched rod and held in position thereby. Air from the auxiliary reservoir can flow to the regulator-valve chamber (H), and also through this valve to the face of the large end of the same piston in the chamber (M). The opening of any of the car doors causes contact to be closed, disconnecting the latch cylinder and the face of the chamber (L) from their main reservoir and opening them to the atmosphere. The reservoir air in the chamber (H) will then move the piston with the slide valve to the extreme upward position, and air will flow to the truck cylinder so that the change in position of the car body can register in the regulating mechanism and proper adjustments be made. As soon as the doors are all closed again, the magnet which put these operations in train is de-energized, the valves return to the normal positions indicated in the diagram, and the truck cylinder will be disconnected from the apparatus and connected again with the atmosphere. The greater the load on the car, the farther to the right the notched rod will be forced, and the more of the chambers (A), (B), (C), etc., will be thrown into operation while the doors remain open.

Some notion of the efficiency of this brake may be gleaned from the statement that when working at full power it will stop, within a space of 194 feet, a car moving at a speed of 30 miles per hour. This is not surprising in view of the fact that the air brake on the ordinary passenger train will do more work in 20 seconds than the locomotive drawing the train can in seven minutes; but it is none the less impressive.

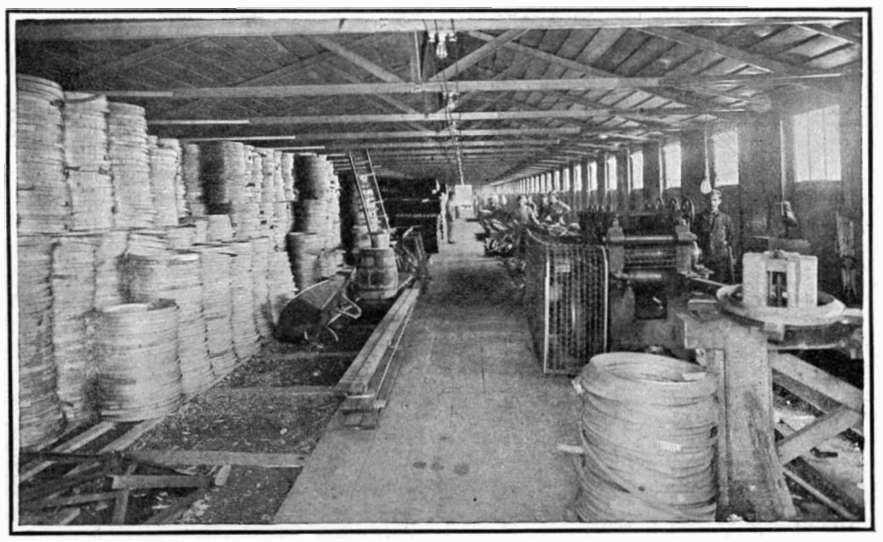
Steel Buildings Made Up of Pinned Panels

THE European war orders came with such suddenness upon American manufacturers that many of them were unable to meet the tremendous volume of business with their existing plant. Plainly it was a matter of adding new wings or buildings to their manufacturing plants; but how to do this and yet handle the business as per schedule was still another question, for the Allies were urgently in need of many of the supplies. Then again, the keen manufacturer was not slow to realize that this sudden rush of business was nothing short of a miracle; it could only be a temporary state of affairs, to disappear again at the conclusion of war in Europe. It would be foolhardy in the extreme to expend big sums of money for permanent additions to the plant when within six months, a year, or several years hence the business would return to its normal state of ante-bellum days. Yet the need for shelter of some sort for the workmen and equipment added to the plants to meet the war orders, was imperative.

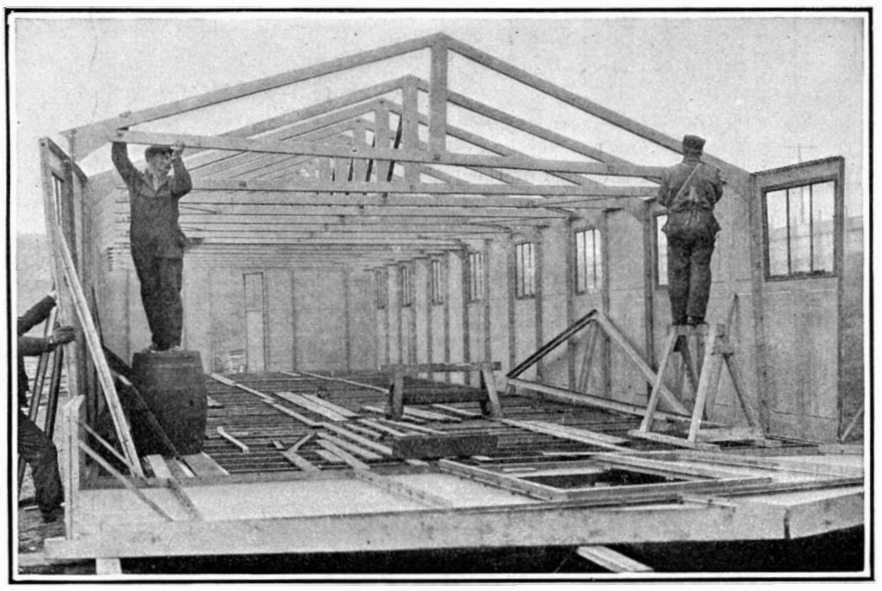
The problem of the munitions or war supplies manufacturer, difficult as it may seem of solution, was met by American ingenuity in the form of portable yet permanent buildings constructed of pressed steel panels and units. It only remained for the manufacturer receiving a large war order to figure out the size of the shelter required to handle the work at hand, and then order the requisite number of panels, doors, trusses, and roofing members. These received, it was but a matter of unpacking the material and employing a few men to assemble the members into an ideal factory building. All the parts fitted with the precision, dispatch, and convenience of the familiar sectional bookcase.



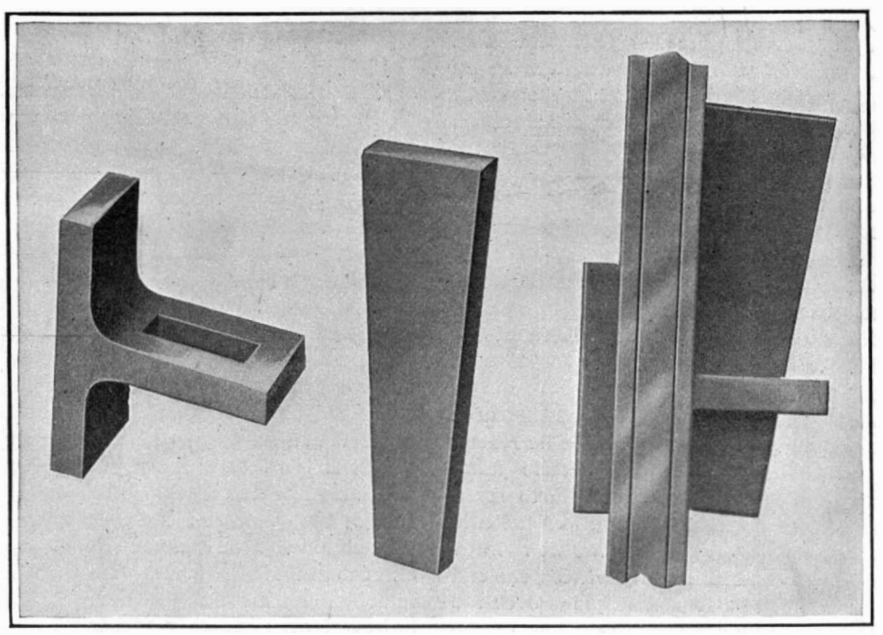
Exterior view of a steel factory building constructed of sections held together by a wedge lock



The interior of a steel building hurriedly erected to meet a sudden increase in business



Erecting the steel trusses in place. The end of the building, ready to raise, appears in foreground



Simple locking device employed for holding the structural members together in a pressed steel building

By means of this simple wedge lock the panels and other members of a steel building are held together. An ordinary hammer is the only tool required in the erection of these structures; no holes need be punched, no rivets driven, and no bolts nor wire are used. The building is assembled with the same ease as a sectional bookcase, and can be made to grow or shrink with the changing conditions of business if necessary

Steel buildings are not a novelty; they were known before the war. And it must not be presupposed that their field of usefulness is limited to factories. As a matter of fact they can be employed for any purpose where some form of shelter is required. The method of construction consists essentially of various pressed steel panels and units which can be assembled by anyone without special tools or equipment. By an ingenious but simple device consisting of a slotted key and locking wedge, the entire building can be fastened together in an incredibly short time. No holes need be punched, no rivets driven, and no bolts nor wire are used. An ordinary hammer is the only tool required.

The various panels used in the construction of the steel buildings are of standard size and interchangeable, permitting buildings of any size or arrangement of wall space, windows and doors. The solid wall panels are manufactured from heavy gage open hearth steel and formed under large dies operated by powerful presses. The corners of the panels are electrically welded to assure maximum strength and weather-tightness.

Light and ventilation are provided for by the use of glazed panels which consist of steel sash welded into the standard wall panel. The sash is complete with pivoting and adjusting devices as well as all hardware. It is claimed that the pivoted ventilator permits 100 per cent ventilation, while the standard push bar and locking device allows wide variation in the adjustment of the ventilators.

Steel doors are furnished for the buildings, insuring fireproofness and permanence. Doors are of standard size and furnished fitted into frame, so are interchangeable with solid and ventilated wall panels. Double and single doors are supplied with either solid or glazed upper panels.

The roofs of the steel buildings are built up of special steel roofing plates so keyed as to assure absolute watertightness, so it is claimed. The roof plates are easily erected and quickly united. The roof is supported by standard steel trusses which are easily set and fastened in place. The truss is complete in itself, requiring no bolting nor riveting in the field, and is so braced as to give great rigidity to the building.

The advantages of the new steel building are obviously numerous. Although the buildings can be rapidly erected and taken down again, they are of a permanent nature as contrasted to the usual portable form of building. They are claimed to be absolutely fireproof and weatherproof. Not the least advantageous feature of the steel buildings is their flexibility: they can be enlarged or made smaller at any time, and the arrangement of the windows, doors, and ventilators can be changed at will. The buildings are adaptable to use as garages, contractors' buildings, factory buildings, hospital buildings, railroad buildings, mining and industrial plants, workmen's cottages, election booths, temporary school houses, summer houses, boat houses, work houses, and for practically every purpose where a permanent or temporary shelter is necessary.

Vessel Sunk by a Whale

A REPORT has been made to the Steamboat Inspection Service that on June 2nd, 1916, while the motor vessel "W. S.," of 20 gross tons, was on its way to Mazatlan, Mexico, a whale came up under the vessel when it was about 7 miles west of Geronimo Island, Mexico, and knocked a hole in the craft, which filled so rapidly that it quickly sank. The crew took to the lifeboat 10 minutes after the accident, and were all rescued.

Animated Cartoons in the Making

How Sixteen Thousand Drawings Are Prepared and Photographed in Producing One Thousand Feet of Motion Picture Film

TO prepare sixteen thousand pen-and-ink cartoons, each a separate and distinct drawing, and then photograph them one at a time on a strip of motion picture film, is the task confronting the cartoonist who would amuse theater-goers by animating his work. And this is only the mechanical part of his new work; there remain numerous other details in the making of animated cartoon films which, together with those mentioned, make the undertaking anything but a sinecure. Perhaps the film requires a month or more in the making; yet on the screen it may take less than a third of an hour to put the cartoon characters through their mirth-provoking antics. Why the vast amount of work?

Somewhere in the downtown section of New York city is the home of the miles of animated cartoons produced by "Rube" Goldberg, whose work in the daily press alone is known to hundreds of thousands of newspaper readers; and here may be learned the many steps in the production of cartoon films, from the inception of the idea to the projection of the film on the screen.

Ideas are the big thing in cartoon productions. According to Mr. Goldberg, everything else is secondary. Given an idea, the remainder of the work is little more than a matter of routine, with occasional calls for ingenuity by way of either reducing the work involved when such is possible, or of securing unusual and clever effects. So it is that when an idea for a production has been properly worked out in the mind of the cartoonist, the mechanical processes are entered into.

Since an animated cartoon film tells its story by means of drawings, its production is entirely a matter of preparing the thousands of drawings necessary to carry out the creator's ideas. The animation of a picture calls for a number of separate drawings, each a trifle different from its predecessor; and it is in knowing just how different to make the successive pictures that the skill centers in producing a cartoon film. This, the all-important, task, is entrusted to one who is the master artist; the other work is relegated to a large staff of artists.

The various backgrounds of an animated cartoon are drawn but once, for it would involve a great volume of useless work if each drawing included its own background. The moving figures or animated objects, on the other hand, must each be drawn over and over again, with every successive drawing slightly different in order to convey the impression of animation or motion when the drawings are flashed rapidly before the eye, in their proper order of sequence. The sheets on which are drawn the animated objects are used in conjunction with the different backgrounds so as to make a complete cartoon. Sometimes the background may be in the form of a sheet of transparent celluloid, especially if the animated figure is to pass in back of the objects pictured on the transparent sheet. More generally, however, the background is in the form of a border covering certain parts of the sheet containing the animated object. Often the latter is cut out more or less so that its figure can be made to overlap portions of the background, to give the appearance of passing in front of the background.

Considerable talent and knowledge of motion is a requisite in properly animating a drawing, in spite of the seeming simplicity of the cartoons when viewed on the screen. The movements of the characters in an animated cartoon must be convincing and at the proper speed. If a man is walking down a street, for instance, the artist must know how many sketches are necessary to have his character cover the distance at the proper gait. If he uses too many sketches, the film production lags; if he uses too few, the movement becomes too jerky, and very trying on the eyes of the audience. It is therefore necessary for the master artist to know how to make each drawing in relation to its mates. He indicates the difference between one drawing and the next, leaving the details of finishing the drawings to other members of the staff.

The master artist works on an easel consisting of a slanting piece of ground glass held in a suitable frame, through which pass the rays of an electric lamp placed below it. Thus it is possible for him to lay a clean piece of paper over the last drawing and indicate on it the difference in position between the new drawing and its predecessor. And by rapidly waving one end of the new drawing, while it is still in place over the preceding one, he can tell at a glance the extent of the animation he has secured.

A considerable amount of thought must be devoted to the audience's understanding of the picture. The center of interest in a cartoon must always be played up prominently by subduing other features. For instance, if one of the characters throws a missile, it is necessary that there be no further movement of his arm after the missile begins to travel across the picture. The character—and every other character, for that matter—must remain absolutely rigid so that the attention of the audience will not be distracted from the missile which at that moment is the center of interest. Then again, when a character is made to say something by the introduction of what is known as a "balloon" within which is hand lettering, there must be no motion in the cartoon until the audience has had time to read it.

Perfect register is a vital consideration in the preparation of animated cartoon drawings, because the tremendous magnification of the films on the screen causes even the slightest lack of register to result in a serious jump and a consequent strain on the eyes. Easels and the photographing apparatus are arranged always to maintain the different sheets of paper in the same relative position. In some instances the sheets are perforated with two holes, so as to engage with pins on the easels and on the photographing apparatus.

It is the preparation of the drawings that requires time; their photographing is a simple matter. As will be noted by the cover drawing of this issue, the photographing of the drawings is accomplished by using a motion picture camera mounted on a substantial wooden frame, with its lens pointing straight downwards. A framing or registering device is placed on the table directly below the camera, while on either side are mercury vapor tubes which supply the necessary light for photographing the drawings. The camera is electrically operated by pressing a push button at the side of the photographer, one picture being taken at a time.

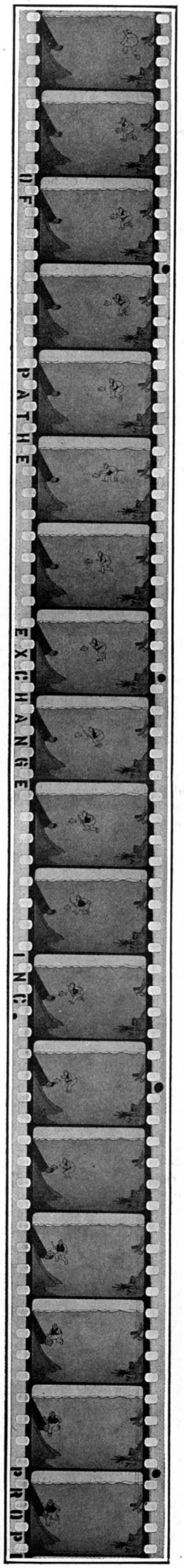
The photographer assembles the backgrounds and animated drawings in their proper order, taking successive pictures by pressing the button. With a pile of drawings to be photographed at one side of him, he takes one at a time, places it in the framing or registering device, presses the button to operate the camera, removes it, and is ready to repeat the process, this time with the next drawing. The work progresses at a fair rate of speed and in a manner not dissimilar to the feeding of a job press, although necessarily slower. In this way the thousands of exposures are made at the rate of sixteen to every foot of film exposed.

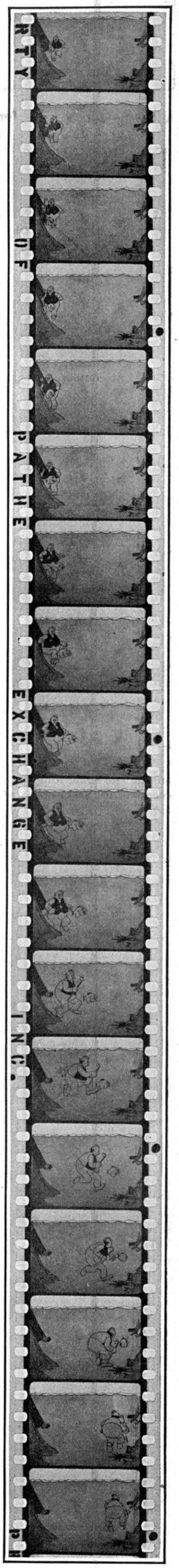
By the clever manipulation of a set of drawings it is sometimes possible to avoid making a large number of drawings for conveying a certain idea. For example, a long freight train moving by one point may be represented by a locomotive, tender and several freight cars, after which a group of freight car drawings may be used several times over to carry out the idea of a long train of cars. This procedure in varied forms to meet specific cases is often resorted to.

With the negative once exposed, there remains little else to complete the production of animated cartoons but developing, editing, inserting the titles, assembling, and then printing as many positive films as may be necessary to allow the film to be simultaneously exhibited in picture theaters here and abroad.

A New Paper-Making Material from India

THE possibilities of utilizing the kaing grass of Burma for paper making have for some years past been investigated by persons interested, and it is now announced that the conversion of this grass into pulp and subsequently into paper can be accomplished in a simple and economical manner. It is expected that arrangements will soon be completed for the collection of the grass, its conversion into pulp, and its shipment in this form to paper makers in the United Kingdom. The yield of unbleached pulp is 39 per cent, calculated on the air-dry grass. This does not compare badly with esparto grass, from which about 43 per cent of unbleached pulp is obtained. Kaing grass grows in great profusion in all parts of Burma, frequently reaching a height of ten feet. As a paper-making material it may be classed with esparto grass, and is much cheaper, though the quality of the pulp is not quite so good as that obtained with esparto. Esparto grass is to a large extent cultivated, whereas kaing grass grows wild and is sometimes rank and coarse. By systematic cutting, however, over properly preserved areas, a finer grass of uniform quality can be obtained in a very short time.





Two successive strips of animated cartoon films, showing the difference between successive drawings

Inventions New and Interesting

Simple Patent Law; Patent Office News; Notes on Trademarks

A Connector Device for Automatically Coupling the Air Hose of Trains

THE introduction of automatic couplers on American railroads was admittedly a step in the right direction; but it was only a partial step. For it is still necessary to-day for trainmen to go between cars that have just been coupled in order to couple the air hose of the brake system. Obviously the ideal arrangement would be not only to couple the cars together by means of their automatic couplers, but also cause the automatic union of the brake hose, and this is what has been accomplished by Joseph Robinson of Branford, Conn., by means of a simple device weighing but 35 pounds.

The new brake-hose coupler, which is illustrated in the accompanying views, is applied to the underside of the car coupler through the medium of a lug, welded to the coupler or cast integral with it, to which lug the bracket of the connector is bolted. A hose of standard construction, except that it is somewhat shorter than the standard, is connected to the angle cock of the car in the usual way. The other end of the hose is secured to the connector by a bayonet joint, requiring but a quarter turn to connect or disconnect. An expansible gasket is inserted in the joint to insure tightness; and as the pressure of the air expands the gasket, the joint is perfectly sealed. For passenger service three hoses are brought to three apertures in the coupler head.

To insure coupling upon curves and under other conditions of car variation, the connector head and pipe are mounted in the bracket by a universal joint, which permits the movement in various directions to meet train and car conditions. Wings for bringing the head into accurate register are provided, and these may be plainly seen in the illustrations. Rubber gaskets for sealing the joint between the heads are also provided.

An important feature of the present connector is its simplicity; it consists of four essential parts, which are inexpensive to manufacture. When two connectors are coupled, they operate practically as one piece, both having the same longitudinal and transverse axes, irrespective of the position of the cars. The universal or toggle joint in the bracket is quite free and flexible when the two connectors are coupled, so that the oscillatory and whipping movement of the cars in running is lost at this joint, and does not get through it to the connector between the heads. Hence there is practically no strain tending to open the heads in rounding curves and under similar circumstances, while the full pressure of the spring at the rear of the bracket—a pressure of from 900 to 1,500 pounds—is acting constantly to hold the heads together.

Mr. Robinson's device was subjected to the most trying tests last September when 50 steel hopper cars engaged in ore service were equipped with the new coupler, for use on the Phoenix Branch of the Marcus Division of the Great Northern Railway. It is an admitted fact that the grades on this branch railroad are abnormal, the curves excessive, and the roughest type of freight is handled. It is truly a trying test for any coupling device. Incidentally the cars were required to operate interchangeably with 140 to 200 other cars not so equipped. The tests were conducted by the Interstate Commerce Commission, under the direction of W. P. Borland of the Safety Appliance Division; and according to reports they proved the coupling device to be in every way adaptable for the purpose intended even under the most difficult conditions of service.

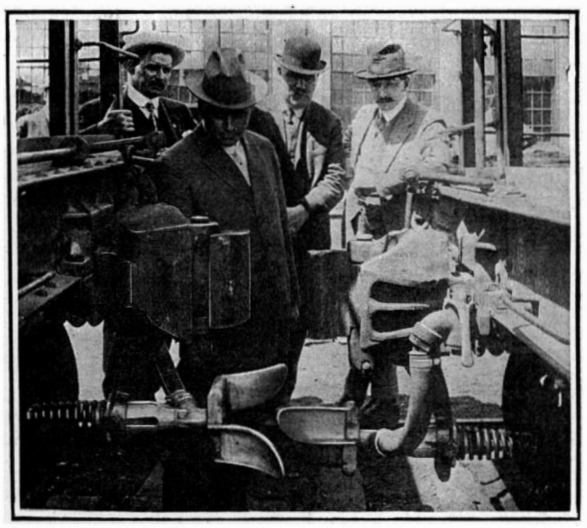
To couple hose automatically is to facilitate the making up and dispatching of trains; to increase the life of hose and to prevent delays. It is to save time, to cut down operating and maintenance expense, and to free employees of a large element of danger which they are now subjected to in going between cars to make the connection by hand, that railroad men are looking forward to the possibilities of the new air hose coupler.

A Device Which Automatically Regulates the Moisture in the Air

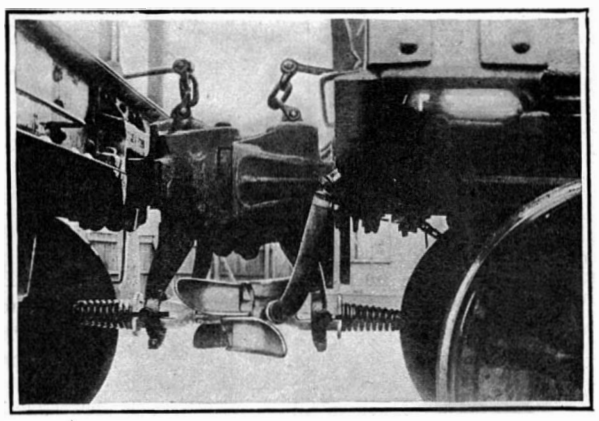
IN such establishments as bakeries, feather factories and tobacco houses, where a certain degree of moisture in the atmosphere is an absolute necessity for the proper preservation of certain materials, the use of a moisture-producing device or humidifier is highly essential. We illustrate a humidifier designed to meet this want.

This device is electrically operated, automatically controlled and entirely self-contained. The humidifier is mounted on the wall or columns of a room or suspended from the ceiling and the control apparatus is provided with a deflector which is in the regulator chamber, and when atmospheric conditions so require the deflector turns the entering water into the overflow.

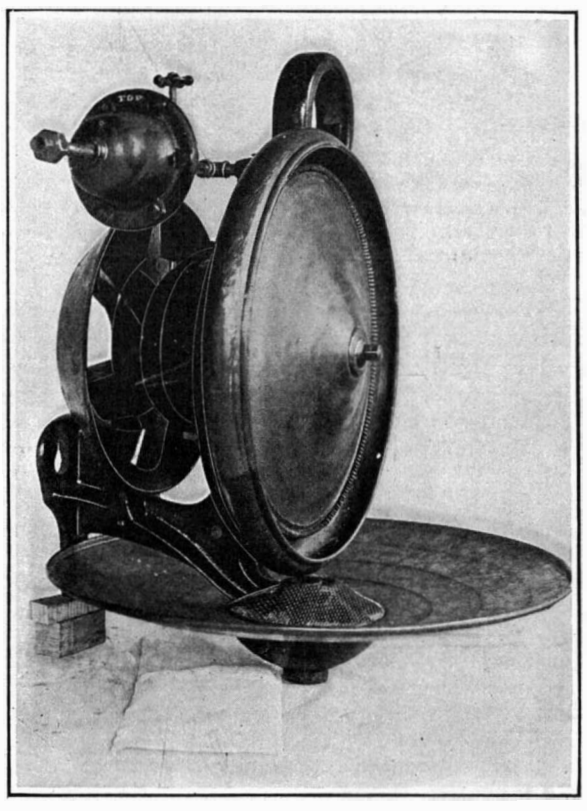
The water enters from above and passes into the regulator chamber, whence it flows directly (when the automatic control permits) to the center of a rapidly revolving disk from which it is thrown by centrifugal force against the teeth of a copper grid at the circumference of the disk. Back of the disk is a fan which forces outward all particles of moisture which are sufficiently fine to float around the edge of the case. The speed of the disk is such as to put a heavy pressure on a very thin film of water, and this film strikes the teeth of the grid with sufficient force, it is claimed, to break up the water completely into minute particles.



Automatic coupler for the brake hose of freight cars, about to be coupled in the presence of railroad officials



A real automatic coupling: Both the couplers and the brake hose are automatically joined



Entirely self-contained and automatic, this device supplies moisture to the air in a room

The revolving disk is 16 inches in diameter and the horizontal drip pan 24 inches. Any number of "heads" may be installed. In one large textile plant, for instance, over 400 heads are in successful operation. Humidifiers of the type shown are particularly in demand in cotton, woolen, silk and flax mills. They are also being utilized in considerable quantities not only in this country but also in Canada, Mexico and Cuba in tobacco-leaf and tobacco manufacturing houses, for which service they are most efficient.

It is of interest to note that these electrical devices are especially useful in the sponge and dough rooms of bakeries, since they automatically maintain the proper humidity desired, thereby preventing the crusting of dough and causing the dough to rise uniformly and produce more loaves to each barrel of flour. By the use of cold water the temperature of a dough room may be reduced 10 deg. or more.

Lately these machines have been employed for humidifying and deodorizing theaters.

It is also claimed that in mines they can be used to prevent explosions of dust. In furniture and automobile factories, they are utilized in fuming and varnish rooms; and in printing establishments they prevent the curling of paper caused by dryness and the sticking due to the presence of static electricity.

Panama Canal Coaling Station at Christobal

THE contract for building the Panama Canal Coaling Station at Cristobal, Canal Zone, was awarded about three years ago to a New Jersey contractor. The various parts of the plant and equipment manufactured in the United States were brought to Cristobal a year later and the work of building the station was begun. The station, which is now practically completed, has so far stood satisfactorily the several official tests required, and it is nearly ready to be formally turned over to the Panama Canal authorities, who have already been using it to some extent.

This coaling station is said to be the largest single coal receiving and distributing plant in the world. It is 1,800 feet long by 400 feet wide, and covers nearly 20 acres. The area set apart for the coal pile is 1,700 feet long by 307 feet wide. The offshore end is excavated to the depth of 27 feet below the water line for a distance of 500 feet for the wet storage of 100,000 tons of coal. Over this wet-storage space coal will be piled to a depth of 35 feet. The dry storage capacity of the station is 385,000 tons and the wet-storage 100,000 tons, making a total of 485,000 tons of coal, exclusive of a 1,500-ton wharf bunker.

This large station is intended to receive and store water-borne run-of-mine coal and deliver it to colliers, barges, railway cars, and into the deck hatches of all types of steamships using the canal. For conveying the coal there is to be built all around the pile a steel viaduct 29 feet high, on which are two separate loops of electric railway three feet wide. To operate the plant to its full capacity of 2,000 tons an hour 88 steel conveyor cars are required for use on this viaduct.

For unloading coal there are four steel towers of skeleton steeple type, each having a grab bucket of 2½ tons capacity operated by a hoisting and a trolley engine, supported on 16 wheels running on two three-foot gage tracks 34 feet 6 inches from center to center. These four unloaders dig coal from colliers and other vessels at a combined rate of 1,000 tons an hour and discharge it into the conveyor cars.

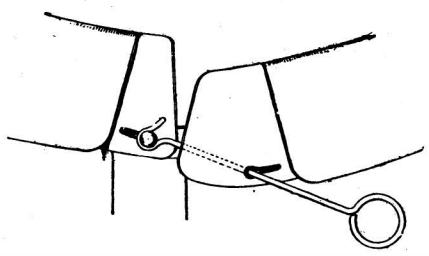
The coal pile is spanned by two steel duplex stocking and reclaiming bridges, each having a stocking capacity of 1,000 tons an hour, and an equal reclaiming capacity, making a joint capacity of 2,000 tons an hour. The bridges are 315 feet long and weigh, with equipment, 1,400 tons each. These bridges, which have tracks for receiving cars from and delivering them to the viaduct tracks, are supported at each end on thirty-two 33-inch steel car wheels, on which the bridges may be moved along the entire length of the storage space in order to enable the cars to discharge coal on any part of the storage pile. Coal is reclaimed from storage by means of one or more of four bridge diggers, two of which are mounted on each of the stocking and reclaiming bridges, and so arranged as to move along the upper chord of the bridges and reclaim coal from any part of the storage pile by means of 5-ton grab buckets operated by a two-motor hoist, which discharges the coal into the conveyor cars. The normal capacity of each digger is 500 tons.

RECENTLY PATENTED INVENTIONS

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

Pertaining to Apparel

COLLAR BUTTON HOOK.—J. ESCHENBRENNER, Farmingdale, L. I., N. Y. This hook is especially designed for buttoning collars to the collar band of a shirt. The invention



COLLAR BUTTON HOOK

improves the construction of buttoning devices of this character so as to be reliable and efficient in use, simple and inexpensive to manufacture, and so designed that the collar can be easily and quickly buttoned without danger of injuring the collar fabric or the buttonhole, and without danger of soiling the collar.

Of Interest to Farmers

DRYING APPARATUS.—F. W. ADLOF, 912 6th Ave., New Brighton, Pa. This invention relates to an apparatus for drying grain, sand or other granular material, and the apparatus is of that type in which the material flows by gravity down a columnar structure or stack through which hot air or fire gases travel for evaporating the moisture from the material to be dried.

BEET BLOCKING MACHINE.—J. L. JENSEN, Richfield, Utah. Mr. Jensen's invention refers to the cultivation of sugar-beets, cotton, and other plants, and provides a machine adapted to be drawn or otherwise propelled transversely of the substantially parallel rows of plants in order to block out, thin, or cut away plants not wanted and to leave plants that are wanted.

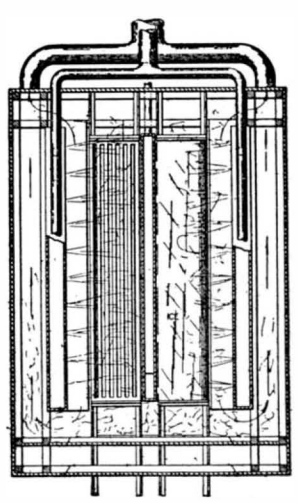
FILTER.—C. D. BURCHENAL, Paia, Maiu, Hawaii. This invention refers to filters for filtering sugar cane juice and other like liquids, and provides a filter arranged to insure a rapid and thorough filtering of the liquid with a view to increase the output of the filter over similar ones of about the same size, to reduce the loss of heat to a minimum, to insure detection of a leak in any individual section of the filter, and to allow of cutting out such section for the time being without interfering with the proper filtering action of the remaining sections.

PEANUT STEMMER.—C. H. HARRINGTON. Address Benthall Machine Co., Inc., 803 Washington St., Suffolk, Va. This invention relates generally to stemming devices for peanuts, forming part of the threshing apparatus therefor, and particularly to an apparatus of this type, including a breast plate downwardly inclined and upon which the peanuts with their stems are fed, together with a plurality of series of stemming saws projecting through conformable slotted openings in the breast plate for the purpose of attaching the mass of peanuts and in working therethrough, removing the stems thereof.

CONDENSER.—F. F. VEGA and R. ABARCA, San Juan, Porto Rico. This invention is an improvement in condensers, and provides mechanism in connection with the central condenser used in dry systems of vacuum pans for granulating sugar for preventing the vapors from interfering with the independent action of the several pans.

Of General Interest

PROCESS OF MANUFACTURING ICE.—M. SCHILDE, 400 Jackson Ave., New Orleans, La. The invention relates to a process of making absolutely clear, hard, pure and core-



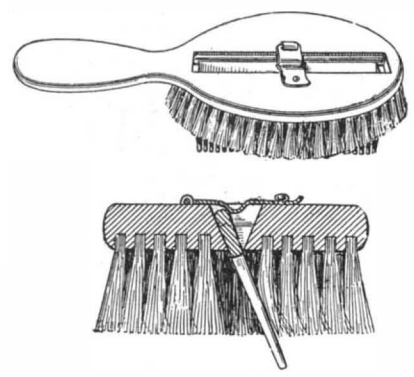
PROCESS OF MANUFACTURING ICE

less ice in block or plate form from raw water, and as compared with other systems it has the advantage that there is a great saving in the installation and operating costs, comparatively very little space required for a given output of ice, the time for freezing blocks or plate materially reduced, and the construction and operation greatly simplified.

FIRE ESCAPE.—L. VIEZZI, 435 7th St., West New York, N. J. This invention provides a main spiral chute spaced from the ground and having an auxiliary chute adapted to slide on the main chute and form a continuation thereof for connecting the main chute with the ground, means being provided for automatically releasing the auxiliary chute so that it may descend by gravity to the ground on the opening of a door leading to the main chute, and means also being provided for sounding an alarm as the auxiliary chute descends.

MEMORIAL BURIAL VAULT.—I. S. DAULEY, 61 Dietz St., Oneonta, N. Y. The invention provides a receptacle constructed of reinforced concrete or other similar material at the burial site, said receptacle being so constructed as to adapt it to be erected or built at the place desired at any time prior to the final use or occupancy of the receptacle from damage or deterioration by the entrance of moisture or other weather influences both before and after being filled.

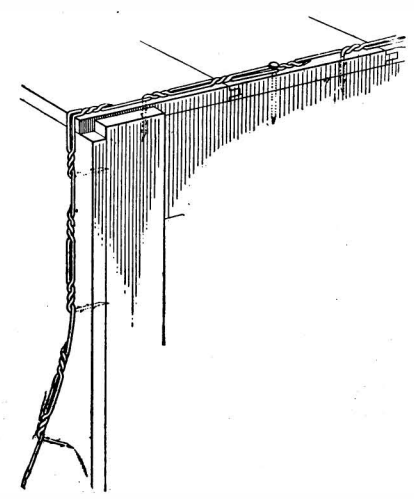
COMBINATION HAIR BRUSH AND COMB.—M. CHRISTIANSEN, 3941 Amundson Ave., Bronx, N. Y., N. Y. This invention relates to a combination hair brush and comb, in which the comb is detachable from the brush and, therefore, each may be used separately. The comb is located between the bristles of the brush. The beveled slot, wherein the comb is



COMBINATION HAIR BRUSH AND COMB.

placed, is supported on both ends and secured on top by a clasp, which is hinged on one side of the slot and fastened on the other side, as shown in the accompanying engraving. It is especially useful to a woman and makes brushing more effective, since the comb grips and digs into the hair. This arrangement is sanitary and simple, and does not mar the appearance of the brush when the comb is removed.

STRAP FASTENING FOR BOXES OR OTHER ARTICLES.—J. H. ZELNICKER. Address Hanan & Pillans, 710 Antwerp Bldg., Mobile, Ala. The principal object of the invention is to provide a strap for use in securing shipping boxes and other receptacles, in



STRAP FASTENING FOR BOXES.

which the fastenings proper form a part of the strap, thus avoiding the inconvenience and expense of using separate or independent fastening devices, such as nails or staples. The strap is of light, yet strong and durable construction, and capable of economical manufacture and use.

WALL CONSTRUCTION.—G. W. LENKERD, care of Clymer Brick and Fire Clay Co., Indiana, Pa. This invention provides means for building a wall, using for such purpose mainly hollow bricks of a uniform standard type or form having straight parallel walls, and with one or more openings entirely through the center from end to end, and at the same time provide a means for forming the corners, trimmings, arches or the like, of solid bricks of a composition and size corresponding to the outside appearance of the hollow bricks.

Machines and Mechanical Devices

LINOTYPE MACHINE.—W. H. JOHNSON, Hilo, Hawaii. This invention relates to the melting pot of a linotype machine whence the molten metal is pumped to the mold for forming the slugs through the medium of arbitrarily arranged matrices, and provides means for preventing dirt, scum, or dross on the surface of the molten metal from passing to the pump and to the mold, thereby insuring clean slugs and a consequent increase of output of the machine.

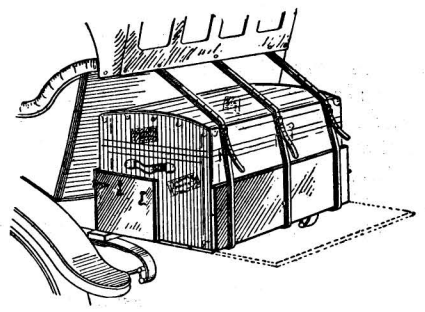
AUTOMATIC ROLLER SUPPORT FOR PLATEN PRINTING PRESSES.—W. S. DRUMMOND, Stafford, Kan. The attachment will not smut the tympan—that is, will not print thereon—it will not interfere with the location of the sheet grippers. The support will not become broken through carelessness of the pressman in placing a gripper over the roller support, as is frequently done with the roller support in general use; it may be positioned even directly underneath the grippers, since it will positively be depressed within the plane of printing form when the impression is made; also the support will not interfere with the placing of guide pins anywhere desired on the tympan.

CHANGE SPEED GEARING.—P. MARCELLOT, 60 Rue des Marais, Paris, Fance. This gearing is essentially characterized by a toothed pinion having either the shape of a solid of revolution, or being conical or plane, this pinion being provided with teeth the number of which decreases with the part of the pinion farthest from the axis of rotation to the part nearest to said axis. This pinion gears with a second toothed pinion, that may be moved relatively to the first, so as to bring it in gear with a region of the first pinion provided with a greater or less number of teeth, thus modifying the speed.

Pertaining to Vehicles

BICYCLE LOCK.—G. A. WEHNER, 420 Habersham St., Savannah, Ga. This invention is an improvement in bicycle locks, and has for an object to provide mechanism for locking the steering post of a bicycle from angular movement, and so arranged that the said mechanism may be held or released by a permutation lock.

ATTACHMENT FOR AUTOMOBILES OR ANY OTHER DESIRED VEHICLES.—J. B. CYPERT, Frost, Tex. The invention provides an attachment which may be formed into a closed receptacle having a lid which may be fastened in place or which may be folded outward into a holder, for a trunk for instance,

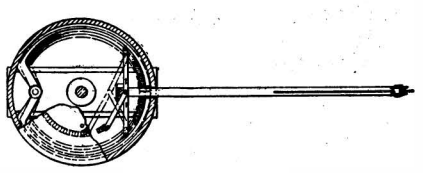


ATTACHMENT FOR AUTOMOBILES AND OTHER VEHICLES.

or for assorted and various articles of luggage, and wherein the attachment is permanently attached to the automobile or may be removed if desired, and which may be arranged either at the side step of the vehicle or in rear of the vehicle, and which may be folded outwardly into a plane surface, forming a table or the like.

AUTOMOBILE TOP.—W. J. GANO, 133 Meadow Lane, New Rochelle, N. Y. This invention provides a construction which may be readily applied and removed at any time. The top may be adjusted and applied so as to occupy a very small space when not in use. The top may be adjusted so as to be moved out of the way at the time the covering member is removed.

TENSION CONTROL.—M. C. HATTON, Upland, Cal. This invention relates to tension devices for controlling the winding or unwind-



TENSION CONTROL

ing of thread from reels or bobbins, whereby the thread on the reel will not become slack and will not tangle. The invention provides a simple, strong, efficient and inexpensive device which is automatic in its action and which starts the rotation of the reel carrier when the thread begins to wind or unwind from the reel.

REAR END SIGNAL FOR VEHICLES.—MULFORD MARTIN, 7 Wall St., New York. This invention provides a signal having means for automatically retiring the same after consummation of the purpose indicated; provides a signal simplified to require no special instructions for reading the same; provides a signal with index devices arranged to compel attention; provides an apparatus with an operating mechanism and housing, minimized as to the space occupied thereby; and provides mechanism for operating the apparatus.

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

Notes and Queries.

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.

(14161) R. L. M. asks: 1. A friend and I have had an argument and we would like you to settle it. We would like to know whether there is an infinite number of prime integers or whether there is some point above which all integers are products of a definite number of factors in different combinations. We would also like to know if there is any way to determine whether large numbers, such as 30,031 and 39,309,269, are factorable or not, other than by the enormous task of attempting to divide them by each of the prime integers below them. Is there any algebraic formula for prime integers, or is there any regularity in their positions with respect to factorable numbers in the arithmetical scale? 2. Will you kindly settle this argument? A. claims that it has been proved by experiment that a body cannot move through space with a speed greater than that of light, and that as its speed approaches that of light the body disintegrates. B. claims that the speed of its motion cannot affect the condition of a body traveling through a vacuum, it being friction with the air that would prevent its excessive speed, and that a body falling a million miles into the sun could, were it not for the great heat, attain a speed equal or greater than that of light. A. 1. We would not say that there are an infinite number of prime numbers, since there is only an infinite number of numbers, and some of these are multiple numbers. Nor is there any formula which will show whether any number is a prime. The subject of factoring is a very difficult one, and much study has been given to it. The tables of numbers have been carried to 10,000,000, and reference to a table is the usual mode of finding factors of large numbers. You will find the Theory of Numbers in *The Encyclopedia Britannica,* XI Edition, Vol. 19, page 851. The history of the Tables is given in the same *Encyclopedia,* Vol. 26, page 326. 2. The speed of light is not approached by any body having an appreciable mass. Light is simply a wave motion of the ether of space, and no gross matter moves through space when light moves through space any more than the water in a wave moves with the wave in its progress over the surface of the ocean. The largest velocity which the sun is able to produce in a small mass falling from an infinite distance to its surface is 383.2 miles per second, since if a body were ejected from the sun with this velocity it would never return, but would pass beyond its gravitating power. No motions are known among the heavenly bodies which approximate the speed of light. This topic is treated briefly in Young's Manual of Astronomy in the chapter upon Celestial Mechanics. We will send the book for $2.50.

(14162) H. S. asks: 1. It is a common fact that if direct current is established in a copper wire, lines of magnetic force grow outward in concentric circles from the wire until the maximum current is established. Now suppose the current to be traveling through a hollow conductor or tube of copper, do lines of magnetic force exhibit themselves inside the tube also? If so, do they travel towards the center of air space in tube or away from center? 2. Suppose we have a hollow tube of copper inside of which we put another solid conductor which is insulated from the outside conductor or tube by fibre or pitch or cotton insulation, as in Fig. 1. Now suppose a magnetic line of force cut across the whole diameter of the cable, we know an E. M. F. would be generated in outside conductor, but what is the condition of inside conductor? Does it have any effect on inside conductor, if so, is it the same as an outside conductor or opposite? I have looked through and read every book I received from you last spring on electricity but have been unable so far to find a solution or anything analogous to these problems. A. 1. Since lines of magnetic force repel each other, we should infer that there would not be any lines of force in a hollow tubular conductor which is traversed lengthwise by an electric current. We have never seen such a conductor, nor do we see any way of testing the matter. If you place a magnetic needle within such a tubular conductor it will draw lines of force to the interior of the tube and thus destroy its value as a testing instrument. 2. It is easy for you to test the arrangement which you propose in your second question. Take a length of several feet, 10-12 feet, of tubing and pass an insulated wire through the tubing. Connect the wire to a delicate galvanometer, and have another insulated wire through which the current from a battery is flowing. You will have the same arrangement as you show in your sketch. You can move the wire which is carrying a current near to the tube, holding it parallel to the tube, as you move it towards and away from the tube. You will thus find whether the induction produces a current in the wire which is within the tube. We do not remember to have seen this question raised before.

(14163) C. J. S. asks: 1. I have read that the standard atmospheric pressure is 760 millimeters. Now, if atmospheric pressure means the weight of the air, I do not see why it should be recorded in linear measure instead of in terms of weight. If it were 760 milligrams, I could readily see into it. Could you please explain this to a beginner in chemistry? 2. What property of nitrogen gives it the preference over a vacuum in an electric light of the Mazda type? A. 1. The normal pressure of the air on one square inch at the sea level is 14.7 lbs. nearly, or 14.6969 lbs., more exactly. This is equal to 1.03329 kilograms per square centimeter. These are the weights of the air resting upon the surfaces named. The 760 millimeters which you quote is the height of a column of mercury which the normal pressure of the atmosphere can sustain in a tube from which the air has been removed, as in the ordinary barometer. Its equivalent in inches is 29.9212. It is usual to omit the words, "of mercury," when we specify the height of the barometer, since every one should understand that. The full expression is "760 millimeters of mercury," "29.7 inches of mercury." It is far more convenient to record this pressure in millimeters or inches of mercury than to change the inches of mercury into pounds at every reading of the barometer. 2. Nitrogen is used in the Mazda lamps because it is incombustible and easily obtained from the atmosphere. It enables a much higher temperature to be employed in the filament, since tungsten has a very high melting point. The presence of the gas is, in itself, not an advantage, since there are connection currents in the bulb and heat is wasted. The pressure of the gas retards the wasting away of the filament. The gain in efficiency is in the use of a thicker filament. The light given by the nitrogen-filled lamp is whiter than that given by other incandescent lamps.

(14164) L. J. W. asks: I have had a lot of trouble in getting a machine that will positively demagnetize a watch and small tools such as we would use in watchmaking. We have a direct current of 110 volts. Have you instructions for making a demagnetizer in any of your back numbers? If so, will you kindly inform me and I will remit price. A. It is not easy to demagnetize steel with the direct current. The best mode of proceeding to demagnetize a watch with the direct current is to fasten a strong cord to the watch and hold the watch by the cord so that it hangs between the poles of a strong electromagnet. Now twirl the watch by the cord so that it whirls rapidly about in the magnetic field, and as it whirls gradually remove it from the field of the magnet. However, the only way to completely remove the magnetism is to use the alternating current. Use an electromagnet. It need not be a horseshoe magnet. A straight core is equally good. Simply lay the watch on the end of the magnet while the current flows. In a few seconds the magnetism will all be gone from the watch. For doing such work you might get a small rotary, run it with the direct current, and take the alternating current from the other end of the machine. The electric companies can supply you with such a machine. Or you can get a small alternating current dynamo, and run it with a direct current motor.

(14165) F. E. K. asks: 1. Does salt in ice retard, or facilitate melting? 2. Is ice colder at its melting point than in a solid state? 3. Why will salt water remain fluid at a temperature which will freeze fresh water? A. 1. Salt on ice forces the melting of both the salt and the ice. A solution of salt and ice results. Heat is always absorbed when a body passes from the solid to the liquid state. In this case the temperature of the solution falls, sometimes very greatly, as in making ice cream. Salt thus facilitates the melting of the ice by enabling it to melt at a temperature below its own melting point in the air. 2. Ice may be cooled to any temperature. In the open air at the normal pressure ice will have the temperature 32° Fahr., the normal freezing point of water. The ice, after freezing, becomes a solid and may be heated and cooled like any other stone. It is simply a mineral then like any other stone. The temperature 32° Fahr. is the hottest which ice can become. At that temperature it turns to water. 3. Any substance dissolved in water lowers the freezing point. Hence, salt water has a lower freezing point than fresh water. Sugar dissolved in water produces the same effect.

(14166) C. S. H. asks: Can you inform me where I can get specific information (a) as to the opportunities waiting (1) a graduate in chemistry (2) a graduate in chemical engineering and (b) the characteristics necessary to take advantage of them? A. 1. We do not know any opportunities waiting for a man such as you describe. But it is very certain that such a man can go out and find work if he seeks for it. The chemical manufacturers are very busy just now, and a good man can be very sure of a job. Still, as we said above, we have no list of vacant places. 2. The qualities which are indispensable to success are: thorough knowledge of one's subject, energy and devotion to one's employer and work. With these a man will not lose his place and will become more valuable every day to his employer.

Recent Research Work Among Egyptian Ruins

AMONG the popular science papers in the latest Smithsonian Annual Report is an article on the excavations at Tell el-Amarna, Egypt, written by the famous Egyptologist, Professor Doctor Ludwig Borchardt, director of the German Institute of Egyptian Archeology, and illustrated with photographic reproductions of the localities excavated and some of the finds.

Tell el-Amarna is the name given to a number of house and tomb ruins in upper Egypt on the east bank of the Nile, located about 190 miles above Cairo. It comprises the ruins of Ekhaton (Akhetaton) a city built in about 1360 B. C. by Akhetaton, the young Pharaoh Amenophis IV, as a new capital of his empire, in place of Thebes, when he ceased to worship the Theban Gods and turned to Aton, the sun-god. He was a religious fanatic and endeavored to establish a new monotheistic religion, which, however, existed only during his reign. After the death of Akhenaton, his court returned to Thebes, and the city built by him was abandoned after an existence of only 20 to 50 years.

The excavations are located in the neighborhood of the modern villages of Hagg Quandil and Et-Till, and have the form of a rough T, indicating an original city area of seven kilometers (4 1-3 miles) by 1.5 kilometers (a little less than a mile). This elongated city was built on a street parallel to the course of the Nile, and extended to the east of the main thoroughfare which still exists as a connecting road between the modern villages.

Dr. Borchardt mentions one dwelling with two gardens, one within the walls hidden from the public view, and the other, in front of the high wall, surrounded only by a low fence so that the passers-by could enjoy the trees and bushes. The largest and best preserved house excavated during the year, was that of General Ra-mose, formerly known as Ptah-mose before he removed to Tell el-Amarna with his master. It seems that at this time, with the constant growth of the sun-cult, names suggestive of other than solar deities became unfashionable in good society. The house of the General is quite close to the confines of the city founded in about the fourth year of Amenophis IV, but was probably not built until some time after the court had moved to Tell el-Amarna, his name being changed when it was nearly finished, as is proved by the alteration on the building.

One of the important things noted about this house was that all the doors were framed in ashlar, or hewn stone, and inscribed with hieroglyphics. New data as regards the "quadrangular" room, hitherto supposed to have been the master's room, was also furnished by this building. Judging from the fact that the name of the mistress of the house appears on the frame of a false door to this room, and that a wardrobe or dressing room, with benches for storage of clothing adjoins it, the author believes that it must have been the "room of wife." The "deep hall" or dining room of this dwelling has been reproduced in colors and, so the author tells us, was probably very charming and comfortable; life in such rooms must have been quite as pleasant, although they were not very well lighted as evidenced by the frequent finds of lamps and lamp stands.

In exploring the environs of the studio of Thutmes, an early native sculptor, a model of a baboon's head in a material resembling wax and another head carved from limestone were found, together with some beautiful ivory carvings. Other objects unearthed included a portrait in relief of Amenophis IV; some impressions from a moldboard, a relief model in resin of the young Pharaoh and his wife; a mask model in limestone; a small tablet with a portion of an Assyrian syllabary; a larger clay tablet covered with cuneiform script relating to a military campaign in western Asia, but without signature of the author.

According to the Smithsonian Report, it is not definitely known where these two tablets came from; whether from the archives of the "house of the royal letter-writer," whether they became scattered or lost in ancient times, or possibly that careless peasants of Et-Till, who discovered the archives in 1887, threw some of the pieces around. Whatever the origin, suggests the author, it is certain that there is hope of still further finds of valuable tablets at Tell el-Amarna, where research had been abandoned.

NEW BOOKS, ETC.

TEXAS, THE MARVELLOUS. The State of the Six Flags. By Nevin O. Winter. Boston: The Page Company, 1916. 8vo.; 355 pp. Price, $3.50 net.

It is to be feared that for most of us Texas is merely the biggest of our states; we are proud of it, but only because of its immensity. Yet its colorful history, wrought out in blood and steel under six flags, and including the successful fight for independence of thirty thousand people opposed by a nation of millions, is one of the most fascinating pages in the chronicle of our world; no less enthralling is the succeeding page now being written, where warfare against hostile man has given place to a no less honorable struggle with the difficulties offered by nature; it is the day of the tractor with its dozen plows, of the miracles wrought by irrigation, and of the establishment of the modern city against the background of the Mission Period. Of all these things, and of many more quite as interesting, Mr. Winter tells us in his "Texas, the Marvellous"; this beautiful and substantial volume is one of the See America First Series, and it takes us over the enchanted ground of the Lone Star's yesterdays and to-days, with more than a hint of a glorious to-morrow. There is a good folding map and a veritable gallery of pictures, among which are a half dozen full-page color plates of unusual distinction.

THE NAVAL ARCHITECT'S AND SHIPBUILDER'S POCKET-BOOK. Formulae, Rules, and Tables. By Clement Mackrow M.I.N.A., and Lloyd Woollard, M.I.N.A. New York: The Norman W. Henley Publishing Co., 1916. 12mo.; 754 pp.; illustrated. Price, $5 net.

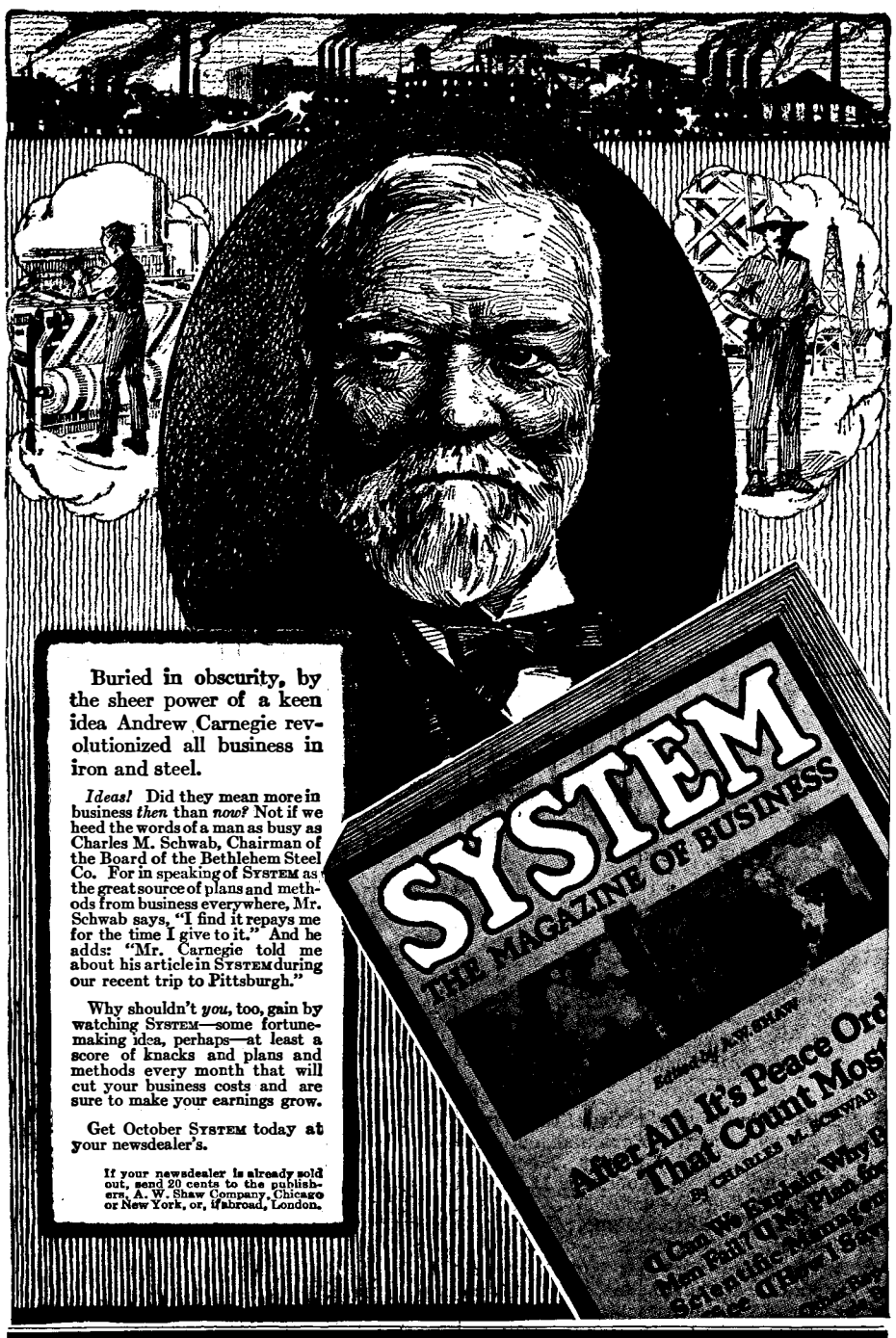
Of handy pocket size, this is just such a compilation of exact information, much of it in the form of tables and formulae, as the everyday exigencies of the shipbuilding industry demands. The issue of an eleventh edition has provided opportunity for bringing the work up to date; much of it has been entirely rewritten, and there is new material on speed and horsepower, with a description of modern methods of powering and of determining forms from the propulsive point of view. The sections on strength of materials and stresses have been extended, and there are two new sections on aeronautics. Marine engineers and surveyors, as well as those engaged in the shipbuilding industry, will appreciate the convenient form of this book and the valuable service it renders them.

DAVISON'S TEXTILE "BLUE BOOK." United States and Canada. New York: Davison Publishing Co., 1916. 8vo.; 1048 pp. Price, office edition, $4; pocket edition, $3; salesmen's directory, $3.

This guide conveys most important information relative to cotton, woolen, silk, jute, flax, and linen manufacturers, dyeing, bleaching, and print works, commission merchants and brokers, and dealers in yarn, silk, cotton, linter, wool, waste, and rags. There is a new list of hundreds of mills that have been built during the past year, or are now under construction, with many new firms. The various directories, arranged alphabetically by states and towns, give the population of the town, the number of railroads, and the date of incorporation, nature of business, and location of each firm, often adding the names of officers and buyers, the number of boilers and the kind of power used, and the number of employees. Canada is separately covered. In addition to the usual detailed index there is a thumb index that will commend itself to the busy man.

PRINCIPLES OF THE TELEPHONE. Part I. Subscribers' Apparatus. By Cyril M. Jansky, B.S., B.A., and Daniel C. Faber, E.E. New York: McGraw-Hill Book Company, 1916. 8vo.; 160 pp.; illustrated. Price, $1.50.

The purpose of this text is plainly to set forth the principles that underlie good construction, at the same time discussing and explaining the various types and makes of subscribers' apparatus with a view to the location and correction of faults. Two other parts are to follow before the work is complete, one dealing with central office equipment and the other with outside construction. The authors have put themselves into close touch with the practical and skillful men of the industry, and the valuable knowledge thus acquired has been embodied in the text. Simplicity and thoroughness mark the work, and all who are engaged in installing, operating, or caring for telephone apparatus will appreciate its many helpful qualities.



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ÆTNA-IZE

If you are in a "Preferred" occupation and under 50 years of age, 3 cents a day brings $1,250 to $3,250 in case of death by accident; $5 to $10 weekly income for life for disability; plus $1,000 to $3,000 for loss of two limbs or eyes, or the income plus $500 to $1,500 for loss of one hand, foot or eye; or $250 for death from any cause. You can make these amounts as much larger as you like by paying more than three cents daily.

Send this coupon now and find out. Don't wait until the accident comes. Don't wait until street car or cellar steps or slippery sidewalk puts you in bed. Remember one man in seven is killed or hurt each year. **Send the coupon now and be safe in time.**

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I have marked the kinds of insurance I wish to know about: Accident ☐, Health ☐, Disability ☐, $250 Life Certificate ☐. My age is ..... years. I am in good health.

22A

THE BALANCE-SHEET OF THE SHAVE

Be business-like. Consider the balance-sheet of the shave.

There are cheaper shaving soaps on earth than Mennen's Shaving Cream. A 5-cent cake of mug soap will last you as long, perhaps even twice as long, as a 25-cent tube of Mennen's Shaving Cream. But why be penny-prudent and face-foolish?

The daily use of the Mennen lather will cost you, liberally estimated, from 25 cents to 75 cents per year more than the frothy, insanitary lather of the old-fashioned mug, the slow-to-respond, quick-to-dry lather of the stick, and the lumpy lather of the shaving powder.

But its instant solubility, its sanitary cleanliness, its convenience and its economy of time and trouble make it cheap by contrast to the man who demands the best. And your experience may have shown you that many soaps bite and smart the face, and that you need some kind of healing lotion after using them.

The soothing, glycerine-laden composition of Mennen's is such that you need never apply a lotion after using. The saving of lotion-cost alone is an important factor. The cost of Mennen's will be found just about to equal the cost of mug-cake, stick, or powder plus lotion.

The Mennen lather makes shaving quicker, easier, safer, and less unpleasant. The rich, creamy firmness of this lather de luxe remains moist during the period of the most leisurely shave. The velvet of its texture is a safeguard against cutting yourself. You need never rub in or relather. Its beard-softening properties lengthen the life of your razor blades and save honing. Its absolute immunity from free caustic prevents any feeling of rawness, and leaves the face soothed and satisfied. Use only Mennen's new Talcum for Men, invisible after application because of its neutral color.

GERHARD MENNEN CHEMICAL CO
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Canadian Factory - Montreal, Quebec
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Enclosed is 10c for which please send me a medium-sized tube of Mennen's Shaving cream and, free, a trial can of Mennen's Talcum for Men.

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