Some Novel Electrical Devices

By Frank C. Perkins

FROST ANNUNCIATOR.—To guard against Jack Frost's occasional visits to orange and lemon orchards, it is the custom to have smudge-pots ready to be lighted at a moment's notice. Very frequently some sections of the orchard experience a much more decided drop in temperature than others on a different level, and hence thermometers are usually located in different sections of the grove, and it is necessary to have a watchman visit them at different hours of the night. At best, frost fighting is not a pleasant job, but to maintain a force of men to meet the emergency, to have them rush out into the cold, dark night filling and lighting smudge-pots,

burning fuel that has cost money, only to find that the alarm was based on faulty, unreliable information, is an experience to try a man's soul. Recently an electric annunciator system has been devised for use in such situations. Thermometers provided with means for breaking an electric circuit when the mercury column falls below a predetermined point, are placed in various parts of the orchard and connected to an annunciator in the owner's or keeper's bedroom. If the thermometer falls to the danger point anywhere in the orchard, the alarm bell of the annunciator is rung and the location of the danger spot is indicated on the annunciator.

ELECTRICALLY LIGHTED INCUBATOR THERMOMETER.—The difficulty of reading an incubator thermometer in the darkness of the machine is obviated by providing a small electric lamp which lights up the scale of the thermometer, brilliantly illuminating the figures, and showing sharply the end of the mercury column. The device is movable so that it may be adjusted to light up any part of the scale desired. The battery of the lamp is placed outside of the incubator, and by pressing a button the thermometer lamp may be lighted. In addition to this there is an electric alarm bell arranged to give an audible signal when the temperature of the incubator is too low or too high.

ELECTRIC FORMING IRON FOR BOOKBINDING.—Pictured in the accompanying illustration are some electric forming irons for bookbinding, which possess the advantage over the ordinary steam iron of being completely portable. The irons are provided with curved tops of diameters suitable for the various sizes of books to be formed. The heat is applied at the top only, so that there is no waste of heat and, of course, none of the annoyances connected with fuel heating. The electric heater has a six-foot cord for attachment to a lamp socket, and the cord is removable at the heater. The energy consumed is from 90 to 180 watts each, according to size.

THREE-SPEED ELECTRIC CAKE MACHINE.—A novel electric machine for cake mixing and beating is illustrated herewith. This machine will do any work that requires mixing, beating, rubbing, whipping or creaming.

It is used to advantage for passing soups, fruit, cheese, mashed vegetables, and the like, the bowl with contents being easily removed from the machine. There are three different speeds provided to cover all the ranges of work required by a baker or chef, and while the machine could easily be arranged for four to six speeds, it has been found that more than three speeds are unnecessary and confusing. The different parts of the machine are clearly designated in the illustration, showing to what a variety of uses the machine may be put in the preparation and cooking of materials.

Frost alarm for locating danger in fruit orchards.

Forming irons for book-binding.

Electrically lighted incubator thermometer.

will be able to witness every move and every act of the star players through a device which was patented last February by Thomas H. Jackson of Scranton, Pa., and which has been in operation for the past two or three months at Atlantic City, Washington, D. C., Rochester, N. Y., and at Mr. Jackson's home. This "player" is unlike many of the contrivances heretofore shown, where both players and the ball have been represented by electric lights or colored glass with lights behind them, but is a faithful representation of the game—diamond, grandstand, fences with advertisements on them, the prize winning bull, the scoreboard in center field, and lastly, umpire and players that do everything but talk. These players throw and catch the ball, run

In the play shown the batter has hit to the second baseman, who throws to third base in order to catch a sliding runner.

Catcher in throwing position.

Catcher in catching position.

Skeleton of the manikin.

A New Baseball Indicator

By Guy E. Mitchell

WHEN the World's Series is played in October between the two championship teams of the National and American leagues, the fans of the two winning cities as well as in the other cities of the leagues

the base lines, slide, run after fly balls, hold consultations on the field and quarrel with the umpire to hide their own short-comings.

The diamond with scenery is fairly large, and occupies the full depth and width of a theater stage. In the front are shown devices so that the spectators may keep track of the outs, balls, strikes, runs for the inning,

errors, fly balls and in certain plays, whether the runner is out or safe. On either side is the "box score." Inclined to the rear is the diamond proper with two grooves encircling it. In one of these the players move, while in the other the runners move from base to base.

The manikins that enact the plays are themselves about a foot and a half high, but the working mechanism, which is not seen by the spectators, is just as long. This consists of a dry elec-

tric cell from which current is carried to a small half-candle-power electric lamp in the hand of the figure. Then through a system of levers the operator is able to raise either right or left arm or both, or cause the figure to bend over. In running bases the wheel attached to the manikin fits the base-runner groove, and in revolving causes the legs to move backward and forward. If the operator wishes to make the figure slide into a base it is necessary only to incline the entire device in the direction desired.

Besides an electrician who operates a switchboard from which hits, flies, and the devices in front are shown, nine men are required to handle the players. One of these men also announces balls and strikes as

the plays are made. At the commencement of the game he calls "play ball." The nine fielding players in their white suits come up through holes in the diamond and take their respective positions, and the batter in his brown suit comes up through a hole near the home plate and with bat in hand takes up his place. A light appears in the pitcher's hand—if he is right-handed, in his right hand, and if left-handed, in his left hand. After "winding up" he delivers the balls toward the batter. The light in his hand is extinguished, and if the pitcher is inclined to be wild it is shown in the catcher's hand, the umpire raises his left arm and the announcer calls "ball one." If the batter makes a safe hit—say for two bases to left field—the progress of the ball is shown on the ground from home plate, between shortstop and third base out into left, where the fielder stoops and the light is shown in his hand. He throws to third base, who in turn relays the ball to the pitcher. Possibly the batter was forced to slide into second, but that play is faithfully presented. If, however, the batter merely hit a fly to left field, a light glows over the shortstop's head, then over the head of the left fielder and then in his hand. When the side is out, the manikins in white go down through holes and off the field and their places are taken by manikins in brown, while the batsmen are dressed in white. If, perchance, a pitcher is being hit very hard and is taken out of the box, that fact is faithfully presented, by a consultation between the captain of the team and his pitcher and the exit of the latter through a hole near his position in the center of the diamond. If the outgoing pitcher be right-handed and his successor left-handed the difference in delivery is faithfully portrayed as is also the usual position occupied by the batters.

Great enthusiasm is aroused among the fans who witness a game on the board; for they see a miniature player representing their pitching idol strike out batter after batter, or the team's slugger hit the ball to all corners of the field with the fielders in pursuit, or maybe the speedy base-runner stealing bases and sliding beyond the reach of

the basemen with all the realism of the game. Once the operators become expert there is no play made on the diamond that cannot be reproduced on the device and shown without the need of explanation.

A French Cycle Racing-car

By S. P. McMinn

THE grotesque-looking little car that appears on our front page this week is the French "Bedelia," though it is not the same "Bedelia" that was illustrated and described in the SCIENTIFIC AMERICAN some weeks ago. It is of the same sort, but this particular one was developed primarily for speed, and its makers held strong hopes that it would win the Grand Prix race for cycle-cars, as these little vehicles are styled, which was run off near Amiens on July 12th; but it only succeeded in getting second place despite its elaborate preparation. Notice the narrow tread and the way the driver and his mechanic are seated one behind the other to reduce wind resistance to the minimum; the disked wheels, and the peculiar manner in which the front axle is braced.

Structurally the car is a little bit different from its predecessors of the same name, and in its make-up there are a number of very interesting features. The engine, for instance, is a twin-cylinder air-cooled machine with the cylinders set at 90 degrees to each other and a bore and stroke of 82 and 100 millimeters, respectively. The motor is mounted on rails so that it may be moved fore and aft a certain distance in order that the driver may loosen or tighten the belts through which the car is driven; this movement of the engine is controlled by a worm gear operated by the driver. There is no clutch, properly speaking, nor is there any countershaft, the drive from the engine being taken directly to the rear wheels through two long belts about twelve feet in length. The driving pulleys are mounted directly on the ends of the engine crankshaft and are of a very unusual type. In the larger part of them there are small centrifugal governors, and as the speed of the car advances, these contrivances draw the cheeks of the driving pulleys together slightly, thus increasing the diameter of the driving pulleys and thereby amplifying the gear ratio between the engine and the road wheels. As the speed of the vehicle drops off, the pulleys spread and the gear ratio automatically is lowered; thus it is practically impossible for the operator to "stall" his motor, for gear changes are taken largely out of his hands. He can, of course, shift the engine and permit the belts to slip, and in this way obtain a very low gear ratio, but a very inefficient one withal. No differential is used, quite as a matter of course, for in rounding curves one of the belts slips slightly, thus compensating for the difference in speed of the driving wheels. Throughout the whole of the construction the aim of the designer has been to obtain the very lightest weight consistent with strength, and to this end the frame is drilled out wherever possible. Steering is done by means of steel cables wound around a bobbin much after the manner of the typical marine steering gear. Two cables are used, one heavy and one light, and both are passed through fiber tubes where there is any likelihood of chafing. If the heavy cable, which is the one normally in use, should be broken through accident, the lighter one then comes into play; virtually, it is nothing more than an emergency rig.

Millions for Naval Armor—the Remedy

By Louis E. Browne

ARMOR plate for modern dreadnoughts costs the United States one third of the whole amount appropriated for the construction of the vessel. It is the most expensive factor which goes into the make-up of the mighty battleship, and its production is limited to just three plants in this country. Armor costs the Government \$454 per ton, and the required 10,000 tons needed for one ship or the 20,000 tons needed for two ships, as the case may be, is equally divided into work for the three steel plants, resulting in an approximate cost to the nation of \$4,540,000 for each ship placed in commission.

Josephus Daniels, Secretary of the Navy, has determined upon a policy looking to the ultimate establishment of a naval armor plant. In a letter to Congress he said that if Congress authorized a plant large enough to produce 10,000 tons per year, or half enough for a two-battleship programme, the cost of the plant would be about \$8,466,000 and the saving in the cost of armor plate would be about \$140 per ton on the price of \$454 now paid. Thus, according to his estimates the United States would save \$1,400,000 on 10,000 tons of armor or the yearly output.

The naval service is divided in opinion as to the advisability of the Government plant. Mr. Daniels frankly stated that many problems must be solved before the wisdom of such a plant could be reached, and that at present no accurate figures are available.

Because of the expensive machinery, the Secretary

of the Navy, in a letter to Congress, says that the armor plate industry is susceptible to monopoly. Investigation shows that foreign governments pay their armor plate manufacturers a higher price for armor than does the United States. Three governments in Europe have established national armor plate factories with the result of great saving. They are France, Russia, and Italy. England and Japan are contemplating governmental plants.

All armor for the Navy is to-day made in the Carnegie, Midvale and Bethlehem plants at practically their own prices, states Mr. Daniels. He further stated that the records clearly show that the manufacturers, convinced that one third of the work is coming to them without reference to the price they bid, have usually submitted bids nearly identical. In the past they have received one third the work anyway, whether high or low bidders. If one bids much lower than the rest, the other two companies have been awarded their share at the figure of the lowest bidder. The Secretary of the Navy makes these assertions upon the authority of letters received from the Midvale Steel Company and the Bethlehem Steel Company.

Special machinery of extremely costly nature is required to manufacture armor plate more than 1½ inches in thickness. The three named companies are practically the only ones in this country having the necessary machinery.

Since John Stevens of Hoboken, N. J., proposed armor for war vessels in 1812, the art has advanced to the present high state of perfection.

The object of the modern hard-faced super-carbonized armor is a metal homogeneously hardened as hard as, if not harder than, the projectile, and at the same time so tough as not to be shattered by the terrific impact. This armor comprises a series of operations which require the greatest care and attention to detail, and usually after receiving the drawings, nine months are required to turn out the finished article.

Fourteen operations are necessary—casting the low-carbon ingot, stripping the ingot, removing the scale, rough-machining, carbonizing, scaling, re-forging, annealing, machining, bending, tempering, rectifying and finish-machining, and erecting. Tests are required after forging and tempering. The ingot is placed in a 50-inch double forging press, and while at red heat subjected to a hydraulic pressure of about 14,000 tons. Then the plate is carbonized. This is an adaptation of the long known process of cementation, which means heating the metal to a high degree of heat in the presence of carbon until the carbon is gradually absorbed into the surface. In bending great care must be exercised, and none but the most skilled artisans operate the huge bending presses, which exert a pressure of 7,000 tons on the plate.

The plate is then heated and sprayed with cold water, at a pressure of 23 pounds to the square inch. The plate usually warps and becomes distorted under the treatment, and even under the most skilled treatment the plates usually have to be rectified. In the Krupp armor characteristic cracks, sometimes one quarter of an inch wide, appear, but under the Harvey process smoother plates are produced.

It is the final machining and rectifying that costs so much money. Besides being bored and smoothed, the armor has to be fitted to each piece which goes into the armor belt and turrets of a ship. It is like a jigsaw puzzle. Little grooves here and there, a notch in one end and an over-lap in the other, and finally the determination of the accurate centers of the holes for the armor bolts, require the constant attention of half a dozen skilled men for six or eight weeks on each piece of armor.

The Secretary of the Navy has faithfully studied the armor problem and is about ready to submit to Congress some definite idea of the extent of the plant. He holds that with a national armor plant, the Government could determine the accurate cost of armor and then, knowing the cost, require the private concerns to submit bids, allowing them a fair profit on the work.

Mr. Daniels has submitted a few general facts to Congress regarding the purchase of armor plate by the Government. The actual cost of armor for war vessels of this nation since its introduction is \$77,103,482, of which \$30,844,153 was paid to the Carnegie Steel Company, \$34,215,112 to the Bethlehem Steel Company, and \$12,044,217 to the Midvale Steel Company. All companies furnishing steel castings for guns and armor plate in the finished product have in the past furnished the product to foreign nations.

Should Congress authorize the plant, it will be located in Washington near the naval gun factory. Three separate buildings would be needed to accommodate the special machinery. It is the present idea, if the plant is established and proves a success, to later establish a similar plant of the same capacity on the Pacific coast. This would put the Government in a position to manufacture all of its armor. There has been a protest against taking the work away from the civilian plants on the grounds that their capacity would be

needed in time of war, but Mr. Daniels replied by saying that should the United States be embroiled in war no warships could be constructed in time to be of service, for the ship could hardly be completed under two years, and it is assumed hardly possible for a modern war to last that length of time.

Ordnance officers in the Navy cite many reasons against the Government plant. First, should the Navy desire advancement in the science of armor, scientists would be needed, and rarely, if ever, has Uncle Sam paid a scientist more than three or four thousand dollars a year, while each of the three companies manufacturing armor for the Navy are to-day paying three or four times that much for several experts. Further, the Navy reserves the right to reject any or all of a consignment of armor, whereas if it were made in a Government shop this loss would fall on the Government instead of on the bidders. Also competition for excellence keeps armor makers striving to excel in the production of their product.

The Electrical Control Boards for the Panama Canal Locks

THE great gates of the locks at Gatun and Miraflores of the Panama Canal will be electrically operated. The control boards, which have been especially designed and built for this purpose, are now on their way from Schenectady to the Canal Zone. In a future issue of the SCIENTIFIC AMERICAN we hope to give an extensive illustrated description of their construction and operation. Suffice to say for the present, that each board is an electrical counterpart in miniature of the lock which it controls. By a very ingenious system of lights and scales the operator can see exactly what is the height of the water in any particular lock and can watch its gradual fall. The boards do not control the lock gates directly, but rather the motors which swing the gates. Readers of the SCIENTIFIC AMERICAN will recall that the lock chambers are 1,000 feet long. Many of the vessels which will use the canal are smaller than this, for which reason provision has been made to divide the chambers into lesser parts for small vessels. This sub-division is electrically effected from the control boards. Particularly noteworthy are the precautions which have been taken to prevent an inadvertent or incorrect operation of the gates. The control handles must be operated in a certain order, automatic locking devices having been provided to prevent their operation in any but the correct manner.

The Current Supplement

IN this week's issue of our SUPPLEMENT Dr. Kunz, the gem expert of Messrs. Tiffany & Company, reports on the new international diamond carat defined as two hundred milligrammes, which will eliminate much confusion from jewelers' negotiations.—T. J. Heller writes on the manufacture of balls for ball-bearings.—J. Blair contributes an article on the Waterproofing of Textile Fabrics.—There are many problems relating to mineral oil still awaiting solution, notably the problem of its origin. An important clue is furnished by the study of the optical activity of the oil, as expounded by F. W. Buschong.—The serious troubles caused by animal growths in the pipes of municipal water supply systems, and the best methods of securing relief, are discussed by S. C. Chapman.—Our Berlin correspondent furnishes an interesting and profusely illustrated article on spiders and their ways.—P. A. Hillhouse writes on "Safety of Life at Sea."—Scenes from the Building Exposition at Leipzig, Germany, are illustrated and described.

Bombs Used Against a Mexican Ship

OPERATING his big biplane under a heavy fire as he circled above the town and bay of Guaymas, on July 28th, Didier Masson, a French aviator, dropped several bombs around the Mexican gunboat "Tampico" lying in the harbor. One of these bombs struck within a few feet of the ship, which probably gave rise to the report that the boat had been sunk. The fact that the aviator operated under fire and escaped unharmed, would seem to emphasize, as has been done on several occasions in the past, that the airship is not to be reckoned with lightly as an instrument of warfare.

Making a Tire Puncture-proof.—A patent, No. 1,062,535, has issued to Thomas S. Causey, assignor of one twelfth to William Dugan, both of Arlington, Texas, for a composition of matter consisting of dextrin, ground asbestos, magnesia, glycerin, wood alcohol and water for preventing leaks in pneumatic tires. A surplus of the composition will tend to maintain a position adjacent the ground during the rotation of the wheel and as soon as the puncture occurs, the air in attempting to escape forces the material into the puncture, blocking the escape of the air.