be wholly switched off by covering the last hole. The path followed by the current in the Wodal interrupter is as follows: The current is supplied to the motor through a variable resistance allowing regulation of the number of revolutions of the motor and, hence, the number of interruptions being readily altered. No special regulating resistance is necessary for the primary of the induction coil, even the most delicate regulation of the current supply being secured by means of the interrupter itself. The Wodal interrupter, like other interrupters, is inserted between the source of current and the primary of the induction coil, the current being conveyed to the mercury jet, and thence through the contact fingers and revolving shaft to the induction coil.

In order to insure more rapid interruptions with a minimum sparking, the reservoir is filled with a quantity of petroleum. As compared with electrolytic interrupters, the Wodal affords the advantage of being perfectly noiseless in operation, and of consuming very little current (about 1½ to 3 amperes). It can be used with any high-tension direct currents.

A NEW ENGLISH TELEPHONIC FIRE ALARM.

BY FRANK C. PERKINS.

A new English system of street fire alarms has recently been brought out by the General Electric Company, Limited, of London, which comprises street alarm and telephone posts located at various points in the city and an annunciator switchboard for the fire station, as shown in the accompanying illustrations, Figs. 1 and 2. As usual the functions of the post are to act as fire-alarm pulls to be operated by the public in the event of fire and to serve as street telephones for the use of the fire brigade in executing their duties, while they may also be employed if desired as police telephones.

The calls are received from the street posts by the annunciator switchboard, which indicates from which post the call is given. The function of the annunciator switchboard is also to discriminate between genuine and accidental calls, such as "grounds"; to allow the lines being tested; and, where required, to serve as a switch for connecting any street post with the police station, or with any official on the system.

The post is fitted with a locking pull to be operated by the public, a vibrating bell, which rings when the pull is operated and indicates that the call is passing through the station, while the stopping of the bell indicates that the call has been attended to. A replacement movement for the pull is provided, as well as the usual telephone receiver, water type microphone transmitter, and induction coil. There is also provided the usual automatic switch hook, call key, lightning arrester, and a two-microfarad condenser which is used in the line test.

The switchboard at the fire station noted in the illustration, Fig. 2, includes an annunciator drop and jack for each post, an 8-inch alarm bell, and an answering plug, also a control indicator, enabling a line which has been used to be kept under observation until the pull in the post is replaced. A control bell gives an audible signal when the pull in the post is replaced, and a discriminating buzzer is provided to allow of determination between real and accidental calls. In addition to the hand combination telephone and magneto generator for the purpose of testing the lines and when required to call any department, a perpetual calendar is provided, as well as an English timepiece, as noted at the top of the switchboard. The Tottenham Urban District Council has installed this system of electric fire alarms, as shown in the accompanying illustration, with thirty-five fire-alarm posts, each fitted with a telephone plug box. When the pull in the post is operated, the battery current passes through the indicator drop, closing the local alarm bell circuit, and the bell in the post at the same time rings.

The fireman attendant in the watchroom inserts his answering plug in the spring jack underneath the fallen shutter, and the discriminating buzzer at once emits a loud buzzing sound. If the alarm were caused by "ground" on the line, the buzzer would not operate, and the brigade would not be called out unnecessarily.

If, on inserting the answering plug, the discriminating buzzer does not operate, it indicates either that someone wishes to telephone, or that the line has become earthed and requires attention. The attendant can ascertain which by listening on the telephone and making the usual inquiries.

After calling out the brigade, the attendant withdraws the answering plug and inserts in its place a plug belonging to the control indicator. This stops the bell ringing in the post, and the control indicator pointer is deflected to the "on" position. The answering plug is now available to receive further calls.

When the post-handle is replaced, the control indicator returns to the "off" position, and the control bell rings continuously until the plug is withdrawn and placed in its normal position. The attendant now inserts his answering plug and listens on the telephone to ascertain if the person replacing the pull wishes to speak to him.

To test the lines from the station, the answering plug is inserted in each spring jack successively and the generator handle turned. If the line is in proper order the discriminating buzzer will be actuated, but if the line is discontinuous, it will remain silent.

At the post, if it is required to speak to the fire station it is only necessary to hold the receiver to the ear and press three or four times on the small push button for the purpose.

TESTING MACHINES AT THE BOSTON INSTITUTE OF TECHNOLOGY.

(*Continued from page 280.*)

ing machine in use at the Institute is of 100,000 pounds capacity, and will test specimens of material up to 26 feet span.

The machine is quite simple. Two steel girders rest at the center on a framework raised 4 inches above the floor. These girders support two movable carriages, which hold the jackscrews used for applying the load. At the center of the machine there are three levers used in weighing the load. Two of these levers are beneath the girders of the machine, and do not show in the cut. The main lever gives a multiplication of 10 to 1. It is of steel, about 6 feet long, and at the larger end it is 13 inches deep and 2¼ inches thick. The load is applied by raising the jacks at the ends of the specimen, and it is weighed through the pull exerted on the levers by the yoke attached to the center of the specimen. The steel girders forming the bed must carry, without undue fiber stress, the maximum load which the machine can exert.

The photograph shows a white pine beam which had been in service at least seventy-five years. The stick is 15 inches deep and 15⅞ inches wide. The span was 20 feet. In the test made on this beam in the testing machine, the load was applied at two points, 1 foot either side of the center. The manner of distributing the load is shown by the beams at the center of the machine. The deflection of the beam was measured in the following way: On either side of the beam a fine steel wire was stretched over pins driven into the beam directly above the supports and at the center of the depth. A ten-pound weight on the end of each wire kept the wire in tension. A micrometer was fastened to each side of the beam at center of the length and depth of the specimen. The faces of the micrometer screws were set parallel with the wires, the screws being perpendicular. To take a set of readings, the screws were turned down till contact was made with the wires.

In determining the torsional strength of substances, three machines are utilized by the students, being of 150,000 inch-pounds, 60,000 inch-pounds, and 6,000 inch-pounds capacity. The accompanying photograph is of the most powerful machine.

The specimens commonly tested in it are from 1½ inches to 2½ inches in diameter and of lengths varying from 3 to 12 feet. The power end of the machine is driven by a 4-inch belt running from a countershaft overhead. The gear is keyed to a 4½-inch diameter steel shaft, which turns once in about fifteen minutes. The holder is a massive piece of cast iron, reinforced by two bands of wrought iron three inches wide and one inch thick, shrunk on the outside. The grips are made of cast iron, faced with cast steel which is fluted on the outer surface. These grips are cams which tend to bite the specimens harder and harder as the twisting head turns to the right. The grips do not require a shouldered specimen. Steel bars 1½ inches in diameter, containing 1.10 per cent carbon, have been gripped without the least difficulty. A handwheel is attached to the driving shaft, so that any desired twisting movement may be held on the specimen. This is also used in adjusting the load accurately, when the angle of twist of the specimen is being noted.

The weighing end is held in a movable carriage which runs on I-beam tracks. A casting, with grips similar to those described above, is attached to a hollow frame made of boiler plate, which is hung from the carriage by an equal-arm lever and links, all turning on hardened steel V-shaped knife edges. From a knife edge at each end of this frame a link runs to a lever, one lever being near the top of the carriage and the other near the bottom. The free ends of these levers connect with the weighing beam shown running across the carriage. As the power end holder turns toward the right, the twisting movement, transmitted through the specimen, will tend to rotate the frame so as to cause the right-hand end to go down and the left-hand end to go up. This causes the free end of the weighing beam to lift, and poise weight must be moved to the right to bring this lever level again.

Two processes, dependent upon the fact that some oils, when brought into contact with finely-crushed ore in water, have the remarkable power of absorbing the particles of certain minerals to the exclusion of others, have been developed.

Engineering Notes.

In Belgium about 85 per cent of the navigable waterways are under the direct control of the state, which is also a large shareholder in the canals conceded to private companies.

Stamped sheet zinc is rapidly coming into use for metal ceilings in places where wood has heretofore been used. In some cases the material is even copper-plated and given a beautiful finish. Those who have had experience with other material will readily appreciate the advantage of using zinc.

Overhead electric trams on the Madeleine-Colombes line have been responsible for an extraordinary accident. The conductor, at the end of his journey, was about to turn the arm from front to rear when, in the act of swinging it by the cord, something caused the springs to act as a powerful catapult, lifting the man 18 feet in the air and hurling him a considerable distance on the roadway. When picked up he was found to have sustained a fracture of the shoulder and both wrists.

A method proposed for testing wood treated to resist fire consists in suddenly heating ½ gramme of the wood by means of an electric current—120 volts, 7 to 10 amperes—to a temperature of 700 to 800 deg. C., and measuring the volume of gas liberated in the course of two minutes. The wood is contained in a platinum wire basket, and the weight of ash and charcoal left can also be determined. A good sample should yield a smaller volume of gas and a larger weight of ash than an untreated sample.

The French Admiralty has quickly recognized the possibilities of the gasoline motor for the propulsion of small war vessels. A vessel intended for police purposes upon the rivers in the French Congo has been launched from Bangui, built under the supervision of the Admiralty, and fitted with two 30-horse-power gasoline engines. The boat is 97 feet 6 inches in length, and is armed with quick-firing guns. It is the largest gasoline-propelled boat that has yet been constructed in France and is purely an experimental vessel to demonstrate the capabilities of this type of engine for small craft of this type.

In Umea, Swedèn, there has recently been installed a factory for the dry distillation of wood, by means of superheated steam, where, in addition to wood coal, wood tar and turpentine oil are recovered. According to the process invented by Mr. Elfström, the steam, superheated to some hundreds of degrees, is conveyed into a tightly-closed horizontal retort of a capacity of 15 cubic meters, filled with resinous wood, when the wood tar, mixed with condensing water, is deposited on the bottom of the latter, the volatile portions being removed with the steam generated by the moisture of the wood. On their way, they are once more highly superheated, and are allowed to exert their effect in a second similar retort. The water vapors, strongly saturated with turpentine oil, are eventually condensed, the turpentine oil being separated readily from the water, while the combustible wood gases are being used for heating the steam producer and the superheater. The wood-tar discharged from time to time from the retort is separated by an addition of common salt from the condenser water, the density of which is thus increased to such an extent as to cause the tar to accumulate on the top. The process is said not only to afford a large output of wood coal, but in addition, wood-tar and turpentine oils of far greater purity than in distillation plants with immediate retort firing, the process being much more uniform in the retorts and too high retort temperatures being avoided.

The Current Supplement.

The current Supplement, No. 1503, contains an unusual variety of interesting scientific articles. Mr. Joseph Horner describes at length, in an excellent review, modern methods of steel casting. His article will be concluded in the next number of the Supplement. Many illustrations accompany the text. H. W. Buck, electrical engineer of the Niagara Falls Power Company, outlines in an instructive way the method of utilizing Niagara power. Prof. Holden's splendid appreciation of Copernicus is concluded. It has been suggested (and the theory has received to some extent the support of experimental proof) that certain kinds of insects derive protection from the grotesqueness or hideousness of their appearance; Mr. Percy Collins convincingly proves the theory in an article entitled "Terrifying Masks and Warning Liveries." Numerous photographs of insects accompany his article and bear out his contentions. Just where King Solomon's Mines may have been situated no one knows. In an excellent article published in the current Supplement, the location of this fabled land of wealth is given on the basis of modern explorations. Prof. Rutherford's painstaking discussion of the radio-activity and emanation of radium is concluded. Prof. Neesen contributes a valuable paper on "Protection from Lightning." The usual notes are likewise published.

Correspondence.

Effect of the Sun's Rays on the Black Race.

To the Editor of the Scientific American:

In your issue of August 20, Prof. Edwin Grant Dexter claims that nature made a mistake in putting the black race in the hot portions of the earth, because black is a better absorber of heat than white.

Let us look at the facts. In the white man the epidermis is a nearly colorless, translucent membrane, while in the black man it is made opaque by the deposit of pigment granules in its lowest layer of cells. Then practically the difference between the two kinds of epidermis is the same as that between a sheet of clear, colorless glass and a sheet of smoked glass; that is, a sheet of glass one side of which has a coating of lampblack. Compared with clear glass, smoked glass is impervious to the sun's rays.

It is to protect the delicate tissue cells of the body from the destructive influences of the heat and chemical rays of the sun that nature has blackened the epidermis of the inhabitant of the tropics.

When we add that the radiating power of the blackened epidermis is relatively as high as its absorbing power, we think that we have proved that nature can be rightly read. James S. Maher,

Health Commissioner of New Haven, Conn.

September 3, 1904.

FIRST COMPETITION FOR THE VANDERBILT INTERNATIONAL AUTOMOBILE CUP.

The one-thousand-dollar international cup, which was recently presented by Mr. William K. Vanderbilt, Jr., to the American Automobile Association for annual competition, was the subject of a most interesting and successful contest, which came off on October 8, on a specially-selected course on Long Island. The donor of the cup was one of the first to import an automobile into this country; he has raced in important international contests abroad, and his object in the presentation of the cup was to promote long-distance road races of this kind, under the conviction that by this means, more than by any other, the development of the very finest design and workmanship can be promoted in the automobile industry in this country. The cup, which is a handsome silver trophy, stands, with its base, about 31 inches in height, and contains 481 ounces of sterling silver. The deed of gift requires that the contests during 1904 and 1905 must be held on American soil; and the competitions of 1906 and subsequent years may be held in the country whose representative club shall have won the cup during the preceding year.

The course is in the form of an isoceles triangle, with two long sides and a short base, the base measuring about 5 miles, and the two sides about 12½ miles each in length, making the total length of the course 30.24 miles. The apex of the triangle is at the western end of the course, at the town of Queens, and the angles of the base are at the village of Jericho and where the Jericho road makes a right-angled turn into the road to Hempstead. There was no limit placed upon the speed of the contestants except at two controls, one at the town of Hicksville, where the course crosses the Long Island Railroad, and another through the village of Hempstead. The first control was 0.4 mile in length, and the automobiles were required to take three minutes in passing through the same. The other control was 1.4 miles in length, and the time of passing through it was to be six minutes. The starting point and finish of the race were on the northern leg of the triangle, at a point about 3 miles from the town of Jericho. Following the direction of the course there was, first, a run of 3 miles at high speed to this turn, which had to be taken at a speed of from 10 to 15 miles an hour; then a stretch of about 2 miles to the Hicksville control, followed by a run of three miles to the turn from the Hicksville into the Hempstead road, after which there was an uninterrupted high-speed run of about 6 miles to the Hempstead control, followed by a fast 5-mile stretch to the sharp turn at the apex of the triangle at Queens. After leaving Queens there was nothing materially to check the speed, except for some rather rough surface, until the turn at Jericho was reached. The actual distance of the course, exclusive of the controls, was therefore 28.44 miles, and as this had to be covered ten times, it made the actual racing distance 284.4 miles in length.

The roads thus traversed are typical macadam roads of that part of Long Island, level for the most part, with some slight undulations, and because of the comparatively dry weather were rather heavily coated with dust. In the preparations for the race, however, $5,000 had been expended in oiling the roads, with the result that there was a 10-foot racing track in the center of the road that was free from dust, hard, and fairly smooth. Some work had been done in smoothing the roads and fixing up the bad spots at turns and grade crossings; but on that portion of the course outside of the controls, that is on the actual race track,

LIST OF COMPETING MACHINES.

Order of Start.	Machine.	Horse Power.	Owned by	Driven by
1	Mercedes Simplex	60	S. B. Stevens	A. L. Campbell
2	De Dietrich	80	De Dietrich et Cie	F. Gabriel
3	Royal Tourist	35	Royal Motor Car Co	J. Tracy
4	Pope Toledo	60	Pope Motor Car Co	A. C. Webb
5	Mercedes	60	Geo. Arents, Jr	G. Arents, Jr.
6	Pope Toledo	24	Pope Motor Car Co	H. H. Lyttle
7	Panhard & Levassor	90	Panhard & Levassor	George Heath
8	Mercedes	60	E. R. Thomas	E. E. Hawley
9	Mercedes Simplex	90	C. Gray Dinsmore	W. Werner
10	Fiat	90	A. G. Vanderbilt	P. Sartori
11	Renault	90	W. G. Brokaw	M. Bernin
12	Clement Bayard	90	A. Clement	A. Clement, Jr.
14	Panhard & Levassor	90	Panhard & Levassor	H. Tart
15	" "	90	" "	G. Teste
16	Packard Gray Wolf	24	Packard Motor Car Co	C. Schmidt
17	S. & M. Simplex	75	F. Croker	F. Croker
18	Mercedes	60	I. Wormser, Jr	J. Luttgen
19	Fiat	90	W. Wallace	W. Wallace

there were, in addition to the three sharp turns at the corners of the triangle, two railroad grade crossings and one or two turns and difficult places that required a slackening of the speed. Moreover, with its customary temerity and willingness to take a chance where any excitement is to be had for the risk, the American public crowded on to the course, and in walking from spot to spot to obtain different points of vantage, did not hesitate to use the oiled center of the road for their perambulations. The course was patroled by motor bicyclists bearing the official badge, each patrol covering a mile and a half of the course. Flagmen were also stationed at the cross roads, and it was to these that the public seemed content to trust for warning that a car was coming, when they would scatter, often only a few seconds before a machine would thunder by at from 60 to 85 miles an hour. This condition of things was the fault of the public and not of the promoters of the race, who had presented verbal and written warning to the public to remain at the fence line and not, under any circumstances, come upon the road.

The race was started promptly at 6 o'clock, and the eighteen contestants were sent off at two-minute intervals, with a standing start. It was expected that a speed of between 50 and 60 miles an hour would be realized, and consequently the cars started at 6 o'clock would be due about 6.35, or close upon the heels of the last machine to start—a 90-horse-power Fiat which was dispatched at 6.32, the other Fiat, owned by A. G. Vanderbilt, having failed to start because of machinery troubles. The first of the racers to complete the circuit was Gabriel, on his 80-horse-power De Dietrich. Then came No. 4, a 60-horse-power Pope-Toledo, followed by the first starter, a 60-horse-power Mercedes. The fourth machine was a 90-horse-power Panhard driven by Heath, who had made up 10½ minutes on the leader in the first round, thus giving early evidence that, barring accidents, he would be well up among the leaders at the finish. The fastest time for the first round, and the fastest for the whole race, was made by Teste on another 90-horse-power Panhard, the circuit being made in 24 minutes and 4 seconds, a speed of 70.9 miles per hour for the whole of the racing course, the controls being omitted. When we remember that speed had to be slowed down below 15 miles an hour for the turns, and that considerable time was lost in getting up speed in leaving the two controls, it can easily be understood that on the long stretches of straightaway track, a rate of between 80 and 85 miles an hour must have been reached. Teste contined to maintain his terrific pace for three rounds, but on the fourth round the clutch broke and he was out of the race. Evidently, he was the most daring driver of the eighteen, his speed for the ninety miles averaging about 68 miles an hour. The second best time in the first round was made by Gabriel in 26 minutes, 57 seconds; and the third fastest by young Frank Croker, driving a 75-horse-power Smith & Mabley Simplex, his time being 27 minutes and 35 seconds. Clement, on a 90-horse-power machine of the same name, made the round in 27 minutes, 51 seconds; and Heath, who was destined to win the race, in 28 minutes and 52 seconds. The trouble to tires and mechanism began with the very first round. Wallace, on a 90-horse-power Fiat, broke his clutch and never completed the round; Tracy, on his 35-horse-power Royal, with a bevel gear drive, broke the driving shaft, made temporary repairs, and completed the round in 2 hours, 29 minutes, 45 seconds. The second round was prolific of disaster. The first to complete it was Gabriel, who made the distance in 27 minutes, 14 seconds; and he was followed by Heath in 28 minutes, 18 seconds; Campbell, driving Thomas' 60-horse-power Mercedes, in 28 minutes, 17 seconds; and Teste in 26 minutes, 37 seconds. It was in this round that the first American machine dropped out of the race, the Royal being hopelessly disabled by a cracked cylinder. It was in this round also that the only fatality of the race occurred. The car driven by George Arents, Jr., a 60-horse-power Mercedes, overturned, killing the mechanic and rendering Arents himself unconscious. Early in the first round, in stopping rather suddenly on entering a control, his car swung and hit a tree.

On the second round, the tire on the wheel which hit the tree flattened and ultimately flew off. Arents seems to have used the brake again too suddenly, with the result that the car skidded badly, and the combined wrench of the brake and the skidding seems to have torn the rim entirely from the wheel, overturning the car, with the fatal results stated. Outside of this there were no serious accidents throughout the whole race.

In this same round the Mercedes car No. 9 was put out by a cracked cylinder, and the 90-horse-power Renault was disabled by the breaking of the main shaft of the bevel drive. In the third round the fastest time was again made by Teste in 25 minutes and 48 seconds, followed by Heath in 26 minutes, 19 seconds; and Gabriel in 27 minutes, 36 seconds. This round was not marked by any withdrawals. The fourth round saw the collapse of Teste, who was leading by a large margin, his failure being due to a broken clutch. The fastest time was that of Heath (27 minutes, 23 seconds) followed by Hawley in 31 minutes and Gabriel in 33 minutes and 30 seconds as the fastest for the round. By this time Heath had a comfortable lead over Gabriel, who was beginning to experience tire troubles. The fifth round found Heath not only keeping up his fine pace, but gradually increasing it, the round being made in 25 minutes and 13 seconds; the next fastest time was made by Teste in another 90-horse-power Panhard in 25 minutes and 40 seconds. Clement, who before the race had been picked as the winner, a young man of twenty-one years, who was driving a machine made by his father's company, had been having tire troubles earlier in the race, but now was beginning to pick up. He made this fifth round in 29 minutes and 33 seconds.

Meanwhile, during the first half of the race, the more moderately-powered American machines had been meeting with varying fortunes. The 60-horse-power Pope-Toledo had trouble chiefly with tires, which threw it hopelessly behind. It did not, however, suffer any permanent breakdown. The little 24-horse-power Pope-Toledo had maintained a remarkably even rate of speed, making the rounds in from 37 to 38 minutes, and with the dropping out of its big foreign opponents, matters began to look promising for its chances. The 24-horse-power Packard machine was doing almost as well; while Croker, in his 75-horse-power Smith & Mabley Simplex, who had made the first two rounds a minute faster than Heath, was making a plucky fight against continually-recurring tire troubles. The fastest time of the sixth round, 31 minutes, was made by Clement who, as the result of a loss of twenty-five minutes by Heath in putting on a new tire, was coming up fast on the leader. In the seventh round, made by Heath in 30 minutes and 5 seconds and by Clement in 30 minutes and 12 seconds, Gabriel, who had been dropping behind in the last two rounds, retired with a broken pump chain. In the eighth round, made by Clement in 33 minutes and 5 seconds, Heath was again delayed by his tires, and took 57 minutes and 27 seconds for the round, thus placing Clement in the lead. From here to the end the race lay between Clement and Heath. At the end of the eighth round, Clement, four minutes ahead of Heath, looked likely to be the winner; but in the ninth and tenth rounds, Heath, in a fine burst of speed, made the circuit in 28 minutes and 52 seconds and 27 minutes and 5 seconds, and managed to come in with a scant margin of 1 minute and 28 seconds, having ridden the whole distance of 284.4 miles at an average speed of 52.22 miles an hour.

The result was decidedly popular, the winner being an American and the car one of the well-known Panhard make. The race was stopped as soon as Clement had passed the line, because of the crowding of the course; but had the race been run out, there is no doubt that the 24-horse-power Pope-Toledo machine would have been third and the 24-horse-power Packard fourth.

Analyzing the race in respect of the nationality of the contestants, we find that of five American cars that started, three finished; of five German Mercedes machines, two finished; of six French machines, two finished, taking first and second place; and of the two Italian machines, one started but did not finish. On