

THE GATHERER:

AN ILLUSTRATED RECORD OF INVENTION, DISCOVERY, LITERATURE, AND SCIENCE.

Correspondents are requested, when applying to the Editor for the names and addresses of the persons from whom further particulars respecting the articles in the GATHERER may be obtained, to forward a stamped and addressed envelope for reply, and in the case of inventors submitting specimens for notice, to prepay the carriage. The Editor cannot in any case guarantee absolute certainty of information, nor can he pledge himself to notice every article or work submitted.

A Small Air-Engine.

The small air-engine which we illustrate herewith is made in several sizes up to about four-horse power, and is intended to be useful in places where small steam or gas engines would be too inconvenient. It consists of an air chamber, heated at its lower end by a slow fire of gas or coal. Above it is a working cylinder containing the piston, which, by its to-and-fro motion, drives the flywheel.

The heated air is admitted to the working cylinder by suitable valves and passages, and there is a "regenerator" for cooling the air. The working piston is moved by the changes of pressure in the air, produced by this means. As the regenerator works, the air is alternately heated and cooled, and the piston keeps in stroke. The engine is easy to start and stop, and requires little attention. Moreover, the smaller sizes can be worked by oil lamps.

Testing Railways.

Professor Milne, F.R.S., and Mr. J. McDonald, of Tokio, Japan, have invented an ingenious apparatus for recording oscillations, which has been employed with success on the railway trains of Japan as a mode of testing the condition of the line and carriages. The oscillations, from whatever cause, are registered in a curve on a band of travelling paper, and subsequently examined. The paper moves at a certain speed, and thus the time of stoppages is also shown. The instrument was recently brought before English men of science at a meeting of the Institution of Civil Engineers.

The Gyroscope at Sea.

We are all more or less familiar with the propensity of a spinning top to keep its position and go on spinning, even though it leans over so much that were it not spinning it must fall on its side. In short, the axis of the top tends to keep its position in space. The gyroscope may be regarded as a scientific top, or teetotum, and when spinning round at a high speed its plane of rotation is practically invariable, and may be regarded as giving a fixed position or

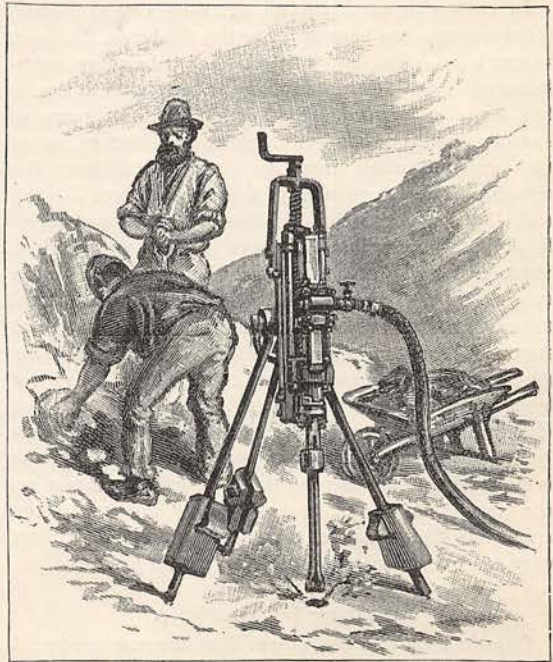
direction in space. This property has recently been taken advantage of on the French man-of-war *Turenne*, in order to correct the compass. The gyroscope is spun, giving a fixed direction, the ship is then swung round and the direction of the compass needle compared with it. A small gyroscope has also been fitted to the ship's sextants, so as to give an invariable line of sight, independent of the motions of the ship, from which to measure angles during rough weather or in the dark.

A Rock Drill.

The tool shown in our engraving is a drill for piercing rocks for the introduction of blasting materials. It consists essentially of a cylinder enclosing a long piston, the rod of which carries a boring bit of steel at its lower end. The piston is actuated by steam or compressed air, which is controlled by an automatic valve admitting and releasing the air alternately, so as to deliver a series of rapid blows on the rock. The machine supersedes the laborious method of drilling by hand with advantage. By its means a hole eight inches deep can be bored in hard granite in ten minutes.

Oil of Wintergreen.

This oil contains ten per cent. of a volatile hydrocarbon called gualtheriden, and ninety per cent. of salicylate of menthol, and, according to Mr. J. D.



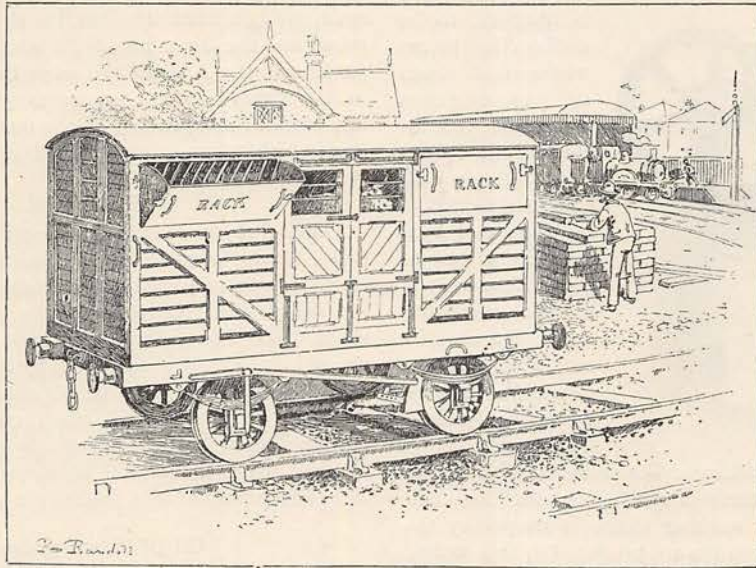
A ROCK DRILL.

Staple, M.R.C.S., it is a good remedy for rheumatism, especially of a chronic order. His method is to rub the part affected with a liniment of equal parts of olive oil and the oil of wintergreen, then wrap the limb in cotton wool, lightly bandaged. The pain generally ceases in five or six hours after the application. In chronic cases the liniment should be well rubbed into the affected region. Mr. Staple says that he has used the oil in over a hundred cases, and of these only two patients failed to be relieved by it.

by decomposing it with an electric current. The caustic soda is removed from the bath, and the chlorine gas given off is absorbed by slaked lime, forming chloride of lime, or bleaching powder, which, like the caustic soda, is of great service in paper-mills.

Physical Tests.

Mr. Francis Galton, F.R.S., the well-known anthropologist, and author of "Hereditary Genius," has brought before the notice of the Civil Service Com-



A FEEDING CATTLE-TRUCK.

For Cattle and Horses.

In conveying cattle by rail, the only way of feeding them hitherto has been to throw the fodder on the floor, where it is soiled and wasted. It is, therefore, satisfactory to learn that a feeding rack adaptable to trucks has been introduced. Each rack holds a truss of hay or more, and, being hinged at the bottom, so as to open outwards, they can be supplied from the outside. The figure shows a rack open on the left and shut on the right. If the fodder is moistened beforehand, the animals are less likely to suffer thirst. Since live-stock are more liable to catch infection on an empty stomach, these humane racks will tend to prevent disease, while keeping the stock in better condition for the market.—In this connection we may mention a new forage cake which has just been patented, and which consists almost entirely of slightly bruised corn, formed into cakes of about four inches square and three-quarters of an inch thick. It is claimed for this novelty that the cakes contain no condiments or spices, and are easily broken by the animals without danger to the teeth, besides being very easily carried or stored for use on a journey.

Bleaching by Electricity.

Caustic soda and chloride of lime are now produced from a solution of common salt (chloride of sodium),

missioners a scheme for adding physical to the literary tests for admission to the Army, Navy, and Civil Services. At a recent lecture to the Society of Arts he gave a clear account of his plan, which is at present in the balance. The proposed tests are only intended to apply to candidates for active professions in which high physical powers are requisite. The present system of examination will not be disturbed. Mr. Galton only wishes to supplement it by another touching faculties which the literary and medical examinations now in vogue do not reach. The new tests would not require any special preparation on the part of the candidate. He does not propose an athletic competition, which would burden the student with an additional training: his object is to test the natural capacities of the man apart from special training, which might give a fictitious and misleading estimate. At present there is a selection made for extraordinary duties—for example, on an Arctic expedition; but Mr. Galton wishes to reduce the matter to a system applicable in general. Character as a whole and a manly bearing might, he thinks, be available for marks as well as the specific tests he would apply. The latter would comprise stature and proportions, such as the span of the arms; height above the seat of the chair when sitting, and length of the neck; weight; strength of grasp; breathing capacity;

quickness of response to a signal by sound ; quickness of muscular action ; simple tests of vision ; simple tests of hearing. These tests have been in operation in the South Kensington Galleries of Science for two years, and only occupy fifteen minutes. Special instruments have also been devised, and these can be seen at Mr. Galton's laboratory, Imperial Institute Road, Queen's Gate, Kensington. In assigning marks for these trials, the examiners would exercise their discretion, for certain faculties would have to be taken together. An upper and a lower limit would be fixed, so as to exclude all candidates below the minimum, and fix the maximum number of marks. For instance, the upper and lower limits for strength of grasp might be 56 and 96 lbs. A person falling below the former would receive no marks, and one rising above the latter would receive the highest number of marks but no more. It must be understood that the marks obtained for these tests will not incapacitate the candidate altogether ; this is left to the medical examination. The marks from these physical tests would be taken in conjunction with those from the literary tests, and thus a person of poor physique, but not hopelessly defective, would have a chance if his mental powers redeemed his physical weakness. In this a great commander or administrator would still be saved to the services.

A New Baby-Cart.

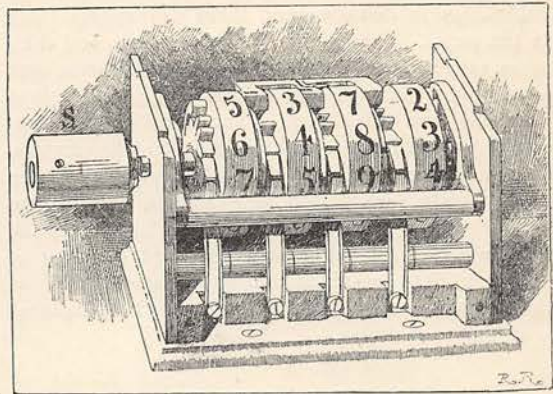


A new perambulator, or rather cart, for children is shown in the figure. Owing to the wide axle and the four legs between the wheels, the vehicle is not apt to be upset, and its body is roomier than a perambulator. The curving legs or stays are padded with india-rubber to prevent jarring. The body is walnut or other ornamental wood, and lined with carriage-cloth, while the seats are cushioned. The vehicle is very light, and capable of holding two children rising three or four years of age.

A New Counter.

Mr. Snelgrove, a well-known inventor, has devised the new counter which we illustrate. The spindle, S, will revolve in either direction, or work a to-and-fro

motion if desired. The units, tens, hundreds, and thousands are shown on dials, worked by panels



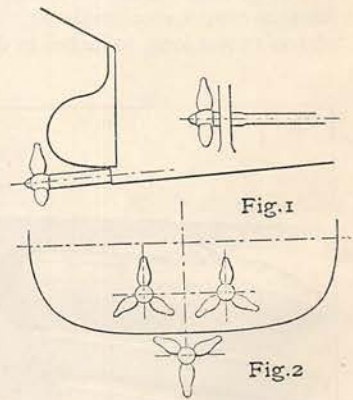
and ratchet wheels in a novel manner, which, however, we need not particularise. The counter is fitted with the usual cover.

A Substitute for Vulcanite.

A new insulating material, intended as a substitute for ebonite, vulcanite, or other preparations of gutta-percha and india-rubber, has been introduced. It is, we understand, a preparation of oils, such as linseed oil, oxydised by treatment with certain acids, and amalgamated with another substance to give it the consistency and mechanical qualities of a practical insulator. As the supply of gutta-percha is nearly exhausted, owing to the reckless destruction of the *Isonandra gutta* tree of the Malay Archipelago, and that of india-rubber is declining, such a material is a desideratum.

Triple Screw Propellers.

Three screw propellers instead of one are likely to be used in future on Atlantic liners and fast men-of-war. As yet, however, the best arrangement of the screws has not been quite determined. Figs. 1 and 2 show how the screws have been placed on the *Montebello* and *Monzambano*, war ships of the Italian navy ; but this plan is not considered satisfactory for ordinary vessels. The naval authorities of the United States have lately been considering the matter, and their experiences should prove of great service.



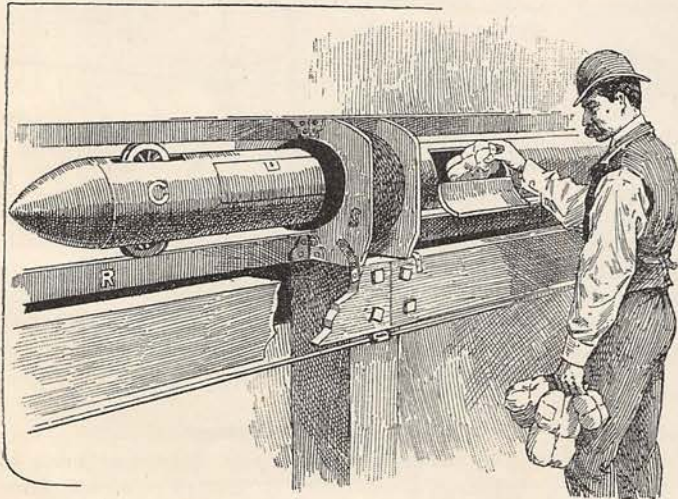
The Codophone.

The "codophone" is a new instrument made by M. Lacape, a well-known Parisian piano manufacturer,

for the service of the Grand Opera House in "Le Réve." It is designed to imitate a carillon, or peal of bells, and consists of 25 pipes of brass, each 36 millimetres in diameter and three millimetres thick in the metal. They are of varying lengths, and their notes range through two octaves. The lowest note is emitted by a pipe 1.85 metres long; the highest from one 0.90 metres long. The former note corresponds to that from a bell weighing 80 kilogrammes, and the latter from one of 33 kilogrammes. The pipes together weigh 100 kilogrammes, and replace bells weighing 2,000 kilogrammes. They are struck by hammers actuated from a keyboard, like that of an organ. Of course, in a confined space, such as that of a concert-hall or opera-house, the loudness is all that is desirable.

An Electric Despatch.

A cylindrical coil of insulated wire, or "solenoid," as it is called, has the power of sucking a mass of soft iron into its hollow when a current of electricity passes through the wire. If, then, a row of such coils are excited by the current one after another, the mass of iron can be drawn through the midst of them like a shuttle through the loom; and if this mass of iron contains a chamber in which a letter or parcel is placed, we shall have an electric despatch or post. This is the principle of the Portelectric Company's despatch, which has been experimentally tried over a short length of track at Boston, United States. The figure shows a portion of the track, which is elevated on stout posts a few feet above the ground. There are two rails, one over the other, so that the cigar-shaped core or carrier of soft iron, C, runs on wheels between them. A door in the carrier allows of the packets or parcels being inserted in it, as illustrated. At intervals of six feet there is a solenoid or hollow bobbin, S, encircling the track, so that the carriage can dart through it on its way to the next. Each coil has about 20 lbs. of number fourteen copper wire insulated. The car is a cylinder of iron 12 feet long, 10 inches in diameter, and 350 lbs.



in weight. The experimental track was not very favourable owing to its curves and grades, but a speed of the carrier of 45 feet per second has been obtained. The dynamo furnishing the current was of the Edco type, and driven by a Sturtevant engine of 20 horsepower. The electromotive force of the current was 1,000 volts. By an ingenious arrangement, the car in its passage actuated the switches and transferred the full power of the current from one solenoid to the next, so as to draw itself along the line. Professor Dolbear, a well-known electrician, who is the engineer for the company, is confident in the ultimate success of the system, and expects the carrier to outstrip the fastest express train.

A Scientific Plummet.

The Standards Department of the Board of Trade have adopted a new plummet in preference to the ordinary one, which is defective. The new design aims

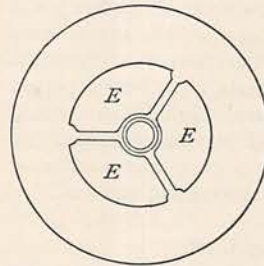


FIG. 1.

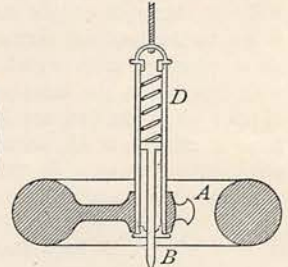


FIG. 2.

at securing a low centre of gravity and a true point which can be seen from above. Fig. 1 shows a cross-section, and Fig. 2 a plan of the device, where A is a heavy ring or wheel of brass or gun-metal, with three light spokes; and B is a fine steel point which when pressed upward by violence retreats into a sheath, D, for protection. A spiral spring in the tube, however, presses it outwards. The point is visible from above on looking through the spaces E, E, E, and for greater accuracy of adjustment a small circular mirror marked with cross-lines is provided. When the mirror is placed on the ground, the plummet is adjusted until its point is opposite its own reflection at the intersection of the lines.

Vinegar Eels.

Tiny "eels," a millimetre or two in length, are sometimes found in weak or impure vinegar. How they get there is uncertain, but they seem to come at certain stages of the manufacture. In vinegar made from wine by the quick process they are very rare. Dr. G. Lindner states that they thrive best on a diet of egg, withstand even strong vinegar, but are killed at once by pure acetic acid. They flourish best at temperatures ranging from 60° to 80° Fahr., and are killed by a temperature over 107° Fahr., or one below the freezing

point. These eels or worms are not exactly dangerous, but it is safer to be sure that the vinegar is of the better sort and free from them, or, at least, to boil and filter it, so as to expel them.

The Frog as a Chameleon.

M. Dutartre, Preparator of the Faculty of Science at Besançon, has discovered that light has a direct action on the colouring matter of a frog's skin, thus enabling the animal to adapt its colour to the medium surrounding it. The colour is due to chromatoblasts and chromatophores in the skin, the former giving a blue and yellow, the latter a black tinge. The direct influence of the light is, however, under the control of the frog's eye by some reflex action, for it is much slower in blind frogs. The change in question is doubtless for a protective purpose, since a frog placed in clear water assumes a lighter shade than when immersed in dark water.

Electricity from Light.

Dr. Samuel Sheldon, of the Polytechnic Institute, Brooklyn, New York, has performed a memorable experiment—to wit, the generation of electricity by the conjoint operation of light and magnetism. It will be remembered that Faraday caused the plane of polarisation of a ray of light to rotate through a certain angle by passing the ray along the "lines of force" between the poles of an electromagnet. This was the first great experiment which demonstrated a hidden connection between the phenomena of light and magnetism. Dr. Sheldon has reversed Faraday's experiment, and by rotating the plane of polarisation of a ray has caused it to generate an electric current and produce magnetism. He sent the ray from an electric arc lamp through a glass containing bisulphide of carbon, a clear liquid with a high refractive index, which took the place of the heavy cobalt glass used in Faraday's well-known experiment. The bisulphide of carbon was placed within a coil of wire corresponding to the electromagnet of Faraday's arrangement, and the terminals of the coil were connected by wire to a telephone in a distant room. The ray of light was polarised in a Nicol prism and reflected from a mirror that oscillated through an angle of 45° three hundred times a second. The plane of polarisation of the ray was thus rocked through an angle of 90° three hundred times a second. When the mirror was oscillating, the telephone was found to emit a musical note, in pitch an octave above the tone made by the oscillating mirror. If the circuit between the coil and the telephone was interrupted, the note ceased, proving that the currents exciting the note in the telephone came from the coil; and Dr. Sheldon concludes that they were generated in the coil by the oscillation of the ray of polarised light. Faraday, in short, by sending a current through the coil of his electromagnet, had rotated the ray of light, while Dr. Sheldon by rotating the ray has produced a current in the coil. The strength of the current was comparatively feeble.

Copper and India-rubber.

Salts of copper are very injurious to india-rubber, and as they are sometimes used in dyeing waterproof cloth, the speedy decay of the fabric is inevitable. According to Mr. William Thomson, F.R.S.E., the oily rubbers are peculiarly apt to deteriorate in this way, because the oil dissolves the copper. Warm copper plates in contact with rubber tend to destroy it, while the metals, silver, zinc, and platinum, have no such effect. The heated copper seems to have the power of oxidising the gum.

An Electrical Tree-Feller.

In the Galician forests a saw is in use for felling trees, which is worked by an electric motor, mounted on a cart, and so carried to the foot of each tree as required. The electric current for the motor is conveyed by wires from the nearest generating station.

Birds and Lightning.

A head gamekeeper at Briese in Prussian Silesia found a covey of fifteen partridges lying dead within the area of a square metre, and on examining the ground concluded that a flash of lightning had killed the birds. The track of the discharge could be traced, and the grass around it was yellow and scorched.

A Book for Boys.

A capital book to put into the hands of any thoughtful boy is "Dick's Holidays, and What He Did with Them" (Fisher Unwin), edited by Mr. James Weston. We are always glad to welcome a work which is calculated to draw out the interest of young people in nature and natural phenomena, and this is one of those best calculated to achieve this desirable result.

For Mothers and Wives

Are the third and fourth volumes of Messrs. Cassell's "Book of the Household," which have just been issued, and complete the work, which deals with almost every branch of household decoration, arrangement, and management, though we would call special attention to such articles as those on washing. As an illustration of the scope of the work, we may mention that while such subjects as laundry work are so effectively treated as we have indicated, others perhaps of almost equal importance to the household well-being, but widely differing from them, as cycling, are also very thoroughly treated. The four handy volumes make a *vade-mecum* for a young housewife, and would form a suitable present for a bride.

An Indian Story.

One of the most remarkable stories of Anglo-Indian life that we have seen is "The Rajah's Heir" (Smith, Elder & Co.) which has just been issued in a single-volume form after having met a very warm welcome in the traditional three volumes. There is an atmosphere of half-explained mystic influence pervading the story; but the tale as a whole is so vividly told,

so instinct with life, and so evidently from the pen of a writer who knows the people and the land she (for we believe the author is a lady) is describing, that one is content to leave something unexplained for the sake of the charm of the story. We confess we should have liked a brighter ending to it, but perhaps that was impossible, so we must be content to leave the hero happily married, though not, alas! to the ill-fated and beautiful heroine.

Old Friends.

All who remember Mr. Palmer Cox's "The Brownies, their Book," will be glad to hear that a sequel to it has just been published by Mr. T. Fisher Unwin, under the title of "Another Brownie Book." The Brownies, as described in the verses or pictured in illustrations, are just as amusing and original as ever;

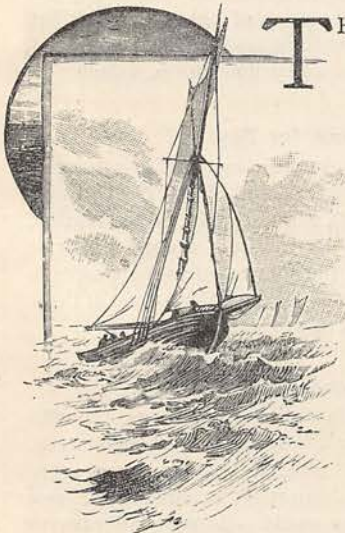
and children, whether of normal or larger growth, will be glad to welcome them on their reappearance, we are sure. A word of praise is due to the publisher for the charming get-up of the volume.

The Last Days Before Caxton.

The period that came between the days of Chaucer and the introduction of the printing-press by Caxton was one of great activity in English literature, as may be seen from the sixth volume of "English Writers" (Cassell), in which Professor Morley deals with the epoch. While it is no doubt true that the introduction of printing did much to secure the spread of literature, we cannot help the thought, as we run through Professor Morley's pages, that the increase in literary effort was equally powerful in securing the introduction of the printing-press.

SHORT STORY COMPETITION.

OPEN TO ALL READERS OF "CASSELL'S MAGAZINE."



THE successful competitions for Eight- and Four-Part Serial Stories, which were held in connection with this Magazine during 1890, must be within the recollection of all our readers. Like all our competitions in former years, they resulted in the introduction to the Editor of writers hitherto unknown to him, and the prize-winners were, one and all, new to the Magazine. The outcome of these two competitions for serial stories was so gratifying to the Editor that he has been encouraged to set on foot a new Competition, this time for Short Stories. The pages of this and other magazines show that where one serial story finds acceptance, four or five short stories are used. The labour involved in writing a short story is neither so great nor so prolonged as that necessitated by a serial, so the Editor trusts that many more of his readers may be led to enter the lists. The stories must be bright, original, and suitable for family reading. Under these conditions,

THREE PRIZES OF TEN POUNDS, EIGHT POUNDS, and FIVE POUNDS respectively, are offered for the Best, Second- and Third-Best Stories of not less than 6,000 words, or more than 8,000 words in length, suitable for use in this Magazine. Each story must be accompanied by a short outline (about 300 words in length) of its plot.

The following are the regulations under which these prizes are offered:—

1. Every reader of the Magazine (not being an ordinary contributor to its pages, or a prize-winner in the 1890 competitions) is eligible to enter the competition.
2. The Editor cannot undertake to answer inquiries having reference to the treatment of the stories in detail. *The particulars given are sufficient for the purposes of the competition, and everything else is left to the judgment and discretion of the competitors.*
3. All communications regarding the stories must be sent in the same packets with the MSS. No subsequent communications (except under Rule 7) can receive any consideration. The award of the judges will be published in the Magazine as soon after the close of the competition as possible, and no information respecting the award will be given to any competitor before this publication.
4. Each MS. must have inscribed on it, or otherwise securely attached to it, the name and postal address of the author, together with a declaration *that the work is original and entirely the sender's own*, to be signed by the author and countersigned by some other trustworthy person—*i.e.*, a magistrate, minister of religion, or householder—with the postal address in both cases.
5. The copyright of the prize work, or works, will become the property of the proprietors of this Magazine.
6. Should two stories be, in the opinion of the judges, of equal merit, any two prizes may be divided between their authors at the discretion of the Editor. Any, or all, of the prizes may be withheld in the event of no story being thought by the judges to be worthy of distinction.
7. All packets containing MSS. should be prepaid. The Editor will not be liable for loss or miscarriage of any work. Unsuccessful competitors may have the MSS. returned to them at their own risk, upon application to the Editor, *after the publication of the award*. Any such application must be accompanied by stamps to defray the cost of carriage.
8. All MSS. must reach the Editor on or before JULY 1st, 1891, and should be addressed—The Editor of CASSELL'S MAGAZINE, La Belle Sauvage, London, E.C., and must have the words "Story Competition" in the top left-hand corner of the envelope or wrapper.