THE GATHERER.

Gas from Oil and Water.

Illuminating gas of superior quality is now made from petroleum oil mixed with water, and both decomposed in a retort. The gases liberated are then washed in a closed tank of cast-iron, and led to the holder where they are stored. In this holder is deposited a residue which is found useful for staining wood besides yielding benzole. Air is added to the gas in the proportions of three of air to one of gas. The process is the invention of Colonel Chamberlain, and the gas is stated to be of 21-candle power, and to cost 1s. 6d. per 1,000 cubic feet for manufacture. It is free from sulphur, which is a great merit, and gives a good light, while giving off very little carbonic acid. It is a healthier gas than that usually made from coal, and flowers do not seem to droop where it is burnt.

A Greenhouse Boiler.

A cheap and efficient boiler for small greenhouses is that shown in Figs. 1 and 2, and known as the "Loughborough Boiler." The pipes to be heated by it are connected direct to the boiler, and it is only necessary to break a hole in the brickwork of the greenhouse, and let the boiler in, as no sunk stoke-hole is required. Fig. 1 is a section through the boiler, and Fig. 2 a front view.

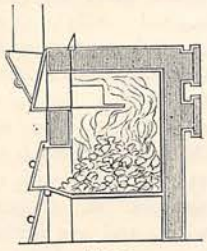


FIG. 1.

As shown, it has three doors, the upper for feeding the fire, the middle for raking it out, and the lowest for removing the ashes. The best fuel is coke and cinders, with a small quantity of coal mixed amongst them. With this arrangement a fire can be readily kept up for twelve hours without attention.

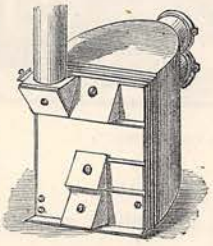


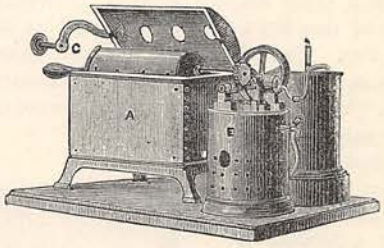
FIG. 2.

An Electric Tram-Car.

An interesting trial of a tram-car driven by electricity stored in Sellon-Volckmar accumulators or storage batteries, placed under the seats, was recently made at Kew on the line of the South Metropolitan Tramways Company. The car ran at the rate of six miles an hour, and Mr. Sellon, one of the inventors of the accumulator used, stated that the cost was about one-third that of horse-power for the work done. The car ran without noise or hitch, and the experiment was deemed a successful one.

A Self-Acting Coffee Roaster.

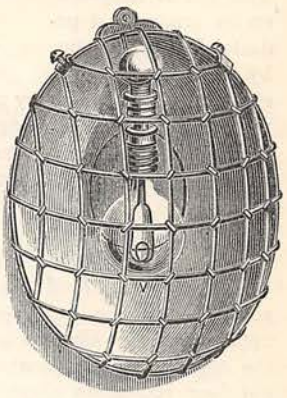
Coffee should be ground while hot, as Continental housewives know full well, though English ones are not as a rule aware of the fact. Therefore the mechanical roaster of Mr. W. Sugg is likely to be serviceable, since it acts on this principle. It consists, as shown in the engraving, of a close-ended cylinder with a sliding door, into which the coffee berries are put.



The cylinder, C, is fitted with a central shaft running through it, and projecting out of it at each end. On one end is a wooden handle, and at the other is the bearing on which it turns. Close to the handle is a cog-wheel, which, when the cylinder is put into its place ready for roasting, gears into an endless worm, driven by a small steam or electric motor. The cylinder is used for roasting in, and it is enclosed in a chamber, A, in the lower part of which are the gas-burners for heating. The little steam-engine, E, turns the cylinder whilst the roasting is going on, and prevents the beans from being charred. The apparatus is suitable for hotels and large mansions, but it would be easy to design a hand-machine on the same principle which would roast coffee very effectively.

A Caged Electric Light.

The glass bulbs of incandescence electric lights are apt to be broken by accident in factories, and the cage which we illustrate is a useful protection to them. It consists of a japanned metal back plate with a reflector inside, and a wire netting "sprung" on in front. The device is also useful for shops and other positions where the risk of breakage is great.



An Indicating Door-Mat.

An alarm foot-mat, for registering the number of persons entering a room or hall, has been brought out in New York by Mr. Applegarth. Under the mat are a series of electric spring contacts in circuit with a battery, and an indicator or alarm-bell, and

when a person treads on the mat the circuit is closed, and the bell rings or the indicator counts one. The same device is applicable as a burglar alarm.

Made-up Mica Crystals.

At the Physical Society, lately, Mr. Lewis Wright exhibited some very interesting and beautiful effects of polarised light, produced by sending the beam of an electric lamp through artificial crystalline plates built up of thin films of mica, after a plan introduced by Mr. Fox. The effects were superior in colour and distinction to those produced by the ordinary selenite designs. Very rich mixtures of colour were also given by a combination of mica films and selenite, after the method of Norremberg. Mr. Wright exhibited a novelty in the form of an "Optical Chromotrope," produced by two mica plates superposed, which displayed a dissolving mixture of the most beautiful hues, in patterns like those of a Turkey carpet.

An Electric Fan.

A drawing-room fan, or punkah, which is worked by a small electric motor, has been devised by Mr. E. J. C. Fear, of Bristol. The fan is mounted on an ornamental pedestal, kept in motion by either a spring or electric motor. A battery concealed in the base of the pedestal keeps the electric motor going. The same arrangement is also used to diffuse perfume through a drawing-room, or a disinfectant vapour through a sick-room.

A Swing for the Nursery.

Children are so fond of a swing that it is surprising some steps have not been taken for introducing apparatus better adapted for in-door use than many of the appliances at present in vogue. As regards the out-door recreation there need be little difficulty. For the nursery, however, a swing like that represented in the accompanying woodcut seems to satisfy most requirements. Two oblong wooden frames are hinged to each other in such a way that they can be folded together when not in use. One frame is furnished at the upper end with a cross-bar, to the lower edge of which two loops, or hooks, are fastened for "catching" the hooks attached to the upper ends of the ropes which support the basket, or cradle, or chair in which the child is to be seated. In the top ends of the side bars of the frame are notches through which the extremities of the cross-bar pass when the frame is erected. A brace hook rod is pivoted to each side bar in order to steady the frame, and when the swing has been put up the hook ends of these rods "engage" with loops or eyes on the sides. When the frames are folded up these rods are fastened into eyes on the sides of the frame. This swing can be erected or taken down very easily.

A SWING FOR THE NURSERY.

An Artificial Aurora.

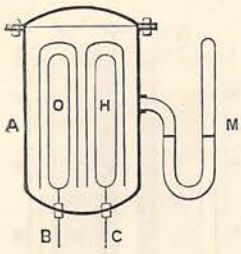
M. Lemstroem, the well-known Helsingfors professor, has recently succeeded in producing what may be considered an artificial aurora on a small scale. During the past winter he chose a station in Finland, just within the Arctic circle, where there are two conical hills — one about 2,000 feet, and the other about 3,000 feet high. He connected the tops of these hills to the earth at their bases with a network of copper wires, and one evening was rewarded by observing a luminous arch proceeding from the summit of one of the hills, and reaching an altitude of 360 feet. This terrestrial discharge into the atmosphere was electricity of "positive" sign.

Killing Rats by Electricity.

An American boy, twelve years old, recently cleared his father's cellar of a pest of rats. Out of some fruit-jars he constructed a battery of three Leyden jars, which he connected and placed upon a large iron plate that touched the tin-foil on the outside. The bait was arranged in such a way that when the rat stepped upon the plate to seize it, he at once completed the connection between the outside and inside of the jars, which were discharged through his body, killing him on the spot. The jars were charged by an electrical machine, also of the boy's construction. From the room above the cellar a couple of wires were run through the floor, and as soon as he heard a rat squeak the young inventor immediately re-charged the machine. In three hours twenty-five rats were slain, and in two days the plague was entirely banished from the cellar.

A Gas Accumulator.

The gas voltaic battery of Sir W. Grove has been adapted by Mr. F. J. Smith as an electric accumulator or store. The gas battery of Grove consists of two platinum strips or electrodes, one immersed in oxygen gas and the other in hydrogen; these gases being produced by the decomposition of water, by the passage of an electric current through it. When the platinum plates are connected by a wire outside the cell, there is a current from the hydrogen to the oxygen side. Mr. Smith increases the duration of this current by accumulating the gases in metal cylinders, H (for hydrogen) and O (for oxygen), as shown in the figure. The platinum plates immersed in these gases are led by wires, B C, through the leaden case, A, of the accumulator, and serve as electrodes. The case is filled with a solution of water with 10 per cent. of sulphuric acid in it, and the charging current liberates the hydrogen and oxygen from it by chemical decomposition. These gases accumulate in the metal reservoirs, H O, and can reach a pressure of seven atmospheres with safety. A manometer, M, serves to indicate this pressure. By collecting the gases under pressure in this way, the power of the accumulator is greatly increased.



Ammonia from Blast-Furnaces.

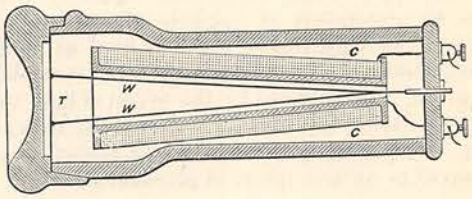
The recovery of ammonia from the gases of the blast-furnace is likely to become an important industry. It has long been known that these gases contain ammonia, and the Gartsherrie Iron Works Company, in Scotland, have erected costly apparatus for extracting it. A ton of sulphate of ammonia is now made there per day from the waste gases of two furnaces. Another firm of Glasgow iron-makers have also devised a process by which the gases are mingled with sulphurous acid gas, which combines with the ammonia to form sulphite and sulphate of ammonia.

Gold-Washing by Electricity.

The ground quartz ore is usually treated with mercury, which abstracts the gold by amalgamating with it; but impurities in the ore, such as arsenical salts, and pyrites, have the effect of "sickening" the mercury so that it cannot take up more gold. Mr. Richard Barker has, however, found out that a current of electricity passed through the mercury cures it of this sickening and keeps it refreshed. The apparatus used consists of an inclined table about six feet wide, with rifles or baths of mercury placed along it at intervals. The bottom of each rifle is of copper and is connected to one pole of an Elmore dynamo-electric generator, while over the top, separated from the mercury by a space of about half an inch, is another plate of copper connected to the other pole of the generator. A stream of water carries the pulverised ore down the table between the mercury and plate, the dirt being carried forward by the current, and the gold retained by the bright clean surface of the mercury. In some cases stirrers and rakes are used in place of the upper pole plate, according to the kind of ore treated. Mr. Barker's invention promises to be very valuable.

A New Telephone.

When a thin rod of iron is enclosed in a long coil of wire, and a current of electricity is sent through the coil, the wire elongates; if the rod be of nickel it contracts. Hence we have the receiving telephone of



Professor Sylvanus P. Thompson, shown in section above, where T is a strained diaphragm or tympan of mica or thin ebonite connected to two rods, W W, one of nickel and one of iron or steel, but both surrounded by the same hollow coil of wire, C C. The ends of this coil are brought to proper binding screws, as shown, in order that the current may pass through them. When the vocal current from the line is flowing through the coil, the simultaneous contraction and expansion of the two rods or wires set the tympan, T, in vibration, and cause it to give out audible sounds. The use of the receiver in this way, of course, implies the presence of a transmitter, into which the sender speaks, at the other end of the line wire.

Power by Telegraph.

M. Deprez, a well-known French electrician, has recently succeeded in transmitting motive-power in a considerable quantity along an ordinary telegraph line, running between Paris and Bourget—five miles of wire. At the recent exhibition at Munich, M. Deprez transmitted power in the same way from Weisbach to Munich, a distance of thirty-four miles, the power being derived from a waterfall which drove a turbine and worked a dynamo-electric generator, G. Fig. 1.

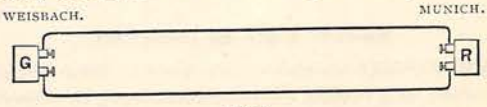


FIG. 1.

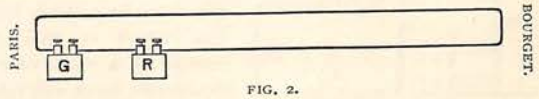


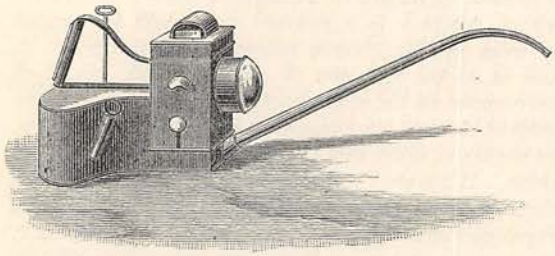
FIG. 2.

This generator was connected by the telegraph wire to another dynamo, R, at Munich, which received the current and was driven round by it, thus reproducing some of the power of the waterfall. But owing to the

great length of line the leakage of power was great, and much better results were got at Paris during the recent trials. In these the generator, G, and the receiver, R, were joined up as in Fig. 2, allowing five miles of line wire between them. In this way, out of six horse-power of energy put into the beginning of the line, two were recovered at the end of it; that is to say, one-third of the total power was transmitted, two-thirds being lost in the apparatus and the telegraph wire.

Softening Hard Rubber.

According to Herr W. Hempel, a German chemist, the best way to make hard rubber supple is to keep it in an atmosphere of sulphide of carbon. The "ebonite" or hard rubber which is used so much in making electrical instruments, because of its insulating properties, is deteriorated by the action of light on its surface. Hence it is usual to keep it in the dark; but Herr Hempel states that vulcanised rubber can be preserved in an atmosphere of petroleum.



A Novel Oil-Can.

A combined oil-lamp and cruse, for the use of engineers, is shown in the accompanying figure. The bull's-eye concentrates the light on the oil-holes or axle to be oiled, and the can behind serves to hold both the lubricator and the liquid fuel for the wick.

Electric Light by Induction.

The ordinary incandescence electric lamp requires a current of a certain electro-motive force to overcome the "resistance" of the filament, just as water requires to have a certain head of pressure to turn a mill-wheel, and the higher the resistance of the lamp the higher the electro-motive force requires to be. The result is that a current of a fixed electro-motive force will not give a good light in a series of lamps unless the resistance of each of these lamps is chosen with respect to its electro-motive force, and lamps of different resistance cannot be fed by the same current.

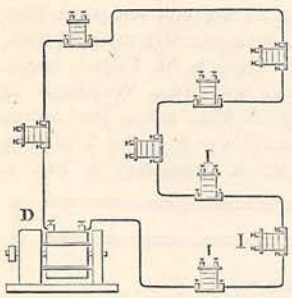


FIG. 1.

In order that this may be done, Messrs. Gaulard and Gibbs have devised the arrangement shown in Fig. 1, where D is the dynamo supplying the current, and I, I, are "induction coils" in circuit with the wires conveying it to different houses. The current of the dynamo may have a relatively feeble electro-motive force, but if it is passed through the primary circuit of the induction coils, it can be made to *induce* another current of a higher electro-motive force in the secondary circuit of the coil. The lamp or lamps to be fed are placed in this circuit, and the electro-motive force feeding them can be regulated by varying the power of the induction coil. Fig. 2 is a section of one of the induction coils, which consists of a core of soft iron, E, inserted into the hollow of the primary circuit through which the current from the dynamo passes. Round this primary circuit are placed other secondary coils, B B, in circuit with the lamps, and the current from the dynamo circulating in the primary circuit induces a current of higher electro-motive force in the secondary coils, which, of course, passes through the filaments of the lamps and lights them up. The current from the dynamo may be of one kind, and interrupted by a vibrating interrupter, as in the Ruhmkorf induction coil, or it may be an "alternating" current—that is to say, of positive and negative pulses of electricity alternately. In this case no interrupter is necessary. The iron core, E, can be pulled out and in, in order to generate a lower or higher electro-motive force in the secondary circuit at will, and thus moderate the light of the lamps, or adjust the current to filaments of different resistance.

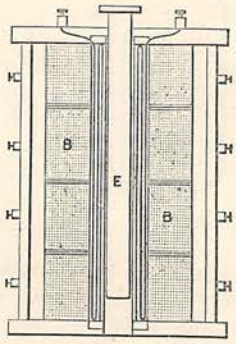


FIG. 2.

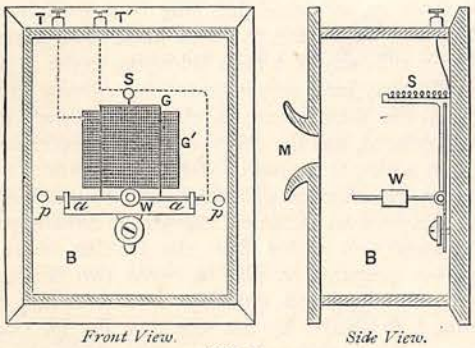
Fireproof Dwellings.

A rather severe test of the fireproof plaster invented by Mr. Hitchins was recently made in London. A brick building of three storeys was built for the purpose and lined on floor, ceiling, and walls with the plaster. The rooms above and below were filled with combustible materials and lighted. The fire raged for half an hour, and notwithstanding the fires above and below, a room on the middle flat was entered and found to be untouched, and cool. To complete the test a large fire was made in that room, and the heat melted the glass of the windows. The three fires were eventually put out by a hose; and the joists under the floors were found to be intact. The test seemed to prove that with Hitchins' fireproof plaster a fire may be confined, at least for a long time, to the apartment in which it originates.

A Wire-Gauze Telephone Transmitter.

The value of metals, and especially iron, in lieu of carbon as a microphone transmitter of speech has

been demonstrated by Mr. J. Munro, C.E., F.A.S., who, assisted by Mr. Benjamin Warwick, has devised the wire-gauze transmitter shown in the accompanying figure. It consists externally of a wooden box, B, having a mouth-piece, M, closed by a piece of thin match-wood. Inside the box is the microphone or "current regulator," which consists of a piece of ordinary iron wire-gauze, G, rather fine in the mesh, and lightly pressed against another piece, G'. The back piece of



Front View. *Side View.*

FIG. 1.

gauze, G', is fixed to the back of the case; but the front piece, G, is carried by a loose axle, *a a*, supported on bearings at each end. From the axle projects an arm, carrying a movable counterweight, W; and the downward pull of the weight, tending to lift the front gauze off the back, is balanced by the force of an adjustable spring, S. The pressure on the microphonic contacts is regulated by this means. The stops, *p p*, serve to limit the sidelong play of the axle carrying the movable gauze, when it is found convenient to shift the position of the latter in adjusting the instrument.

The current enters and leaves the regulator by the terminals, T T'. A small induction coil (not shown) is usually inserted between the transmitter and the line, the "primary" of the coil being in circuit with the battery and the regulator, while the "secondary" is in circuit with the line-wire and receiving telephone.

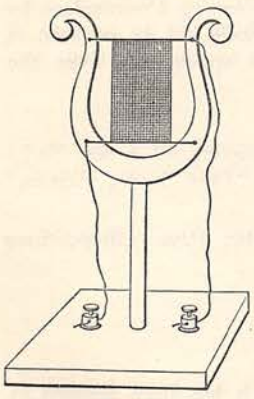


FIG. 2.

On speaking into the mouth-piece in the usual manner, the air-waves set up by the voice pass through the two gauzes and agitate the contacts between them, thereby modifying the current so as to make the telephone repeat the words. The match-board diaphragm is not an essential, as the sound-waves act directly on the contacts, but it is useful in screening the delicate regulator from the rudeness of the breath, and fixing the distance at which the speaker should keep. A grating across the mouth-piece will also answer the same purpose; and in both cases the sound-waves traverse the grating after the manner of an Æolian harp. A transmitter of gauze arranged by Mr. Munro in the form of a "lyre," and shown in Fig. 2, is so sensitive that it will transmit the voice when the speaker is two feet distant.

Mr. Munro has devised other forms of metal transmitters, in which the wire-gauze is replaced by metal granules, especially ¼ inch screw-nails, and "spongy" iron, such as is used for filters, or by a strip of iron chain or chain-mail, the contacts between the links forming metal microphones.

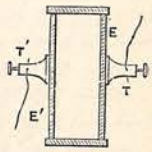


FIG. 3.

Fig. 3 is a little "speaking coffer," made in this way. It consists of a small wooden box or chest with metal sides, E E', serving as electrodes to convey the current by terminals, T T', and containing inside a loose mass of small iron screw-nails, or drillings. The gauze transmitter, however, gives the best results. We may add that a "thermo-electric microphone," consisting of iron and German silver (or bismuth) wire-gauze, may also be constructed in the way described, so as to generate its own current by the application of heat to the contacts.

Luminous Dress Trimmings.

Ladies' party-dresses are now trimmed with rows of tiny incandescence electric lamps instead of flowers. The electric current is supplied by a small battery carried by the wearer of the dress, and the light is at her control.

The Electric Light and the Microscope.

The small incandescence electric lamp of Mr. Swan has been applied with great success to the microscope by Mr. C. H. Stearn. Oil-lamps are troublesome, unclean, and do not give so bright a light as electricity for microscopic work. Mr. Stearn applies the incandescence lamp in three places to the microscope, namely, below the stage, on it, and below the substage, so as to illuminate the object above, below, or for use with the polariscope. But only one lamp is absolutely necessary, as it can be readily shifted to each of these three places, and the current sent to it by means of a small switch. A lamp giving a light of two or three candles, and fed by two or three Grove or Bunsen cells, is all that is required. When electricity is supplied to houses for lighting purposes, a battery will not be wanted.

Steel Crystals.

M. Holtzer, a pupil of the Paris School of Mines, has observed on bars of cemented steel certain small cavities containing carbon, and in several of them he found clusters of crystals resembling fir-trees, which, in the opinion of M. Descloiseaux, are no other than crystals of steel.

Acid-Resisting Bricks.

"Metalline" bricks, made of the best Welsh clays, are now used in the chemical works of Lancashire to resist the action of acids and alkalies. The brick is

very dense and free from pores, and is formed under pressure. They are used for "revolver" linings; and such is their power of resisting acids, that a brick boiled for two months continuously in vitriol was quite unaffected.

A New Tricycle.

Mr. W. J. Fraser, who has long studied the mechanical properties of tricycles, has introduced a new one, which is better suited to the natural movements of the body than the older types. It is worked both by hands and feet, and the weight of the body is utilised in driving it. In appearance it is like an ordinary "front-steerer," made of a steel tube frame, with two large driving wheels four feet six inches in diameter, and a front steering wheel fifteen inches in diameter. The pedals hang on a central bar supported across the frame-work. The hand-levers are vertical, and also supported by the frame-work. The handles are level with the elbow, and placed within easy reach. A saddle-seat is provided over the pedals, allowing the legs freedom to swing and work the pedals, as if the rider were walking and at the same time sitting. On ascending a hill the tricyclist throws all his weight on the pedals. The machine is adapted to suit the movements of the body in walking, and is likely to prove a decided improvement on the ordinary tricycle.

A Cheese-making Berry.

A cheese-making berry has recently been discovered in India, which seems to be a capital substitute for rennet. Puneria, as the natives call it, is the berry of a plant known scientifically as *Withania coagulans*—a shrub which is common in the Punjab and Trans-Indus territory, and which has long been used by the Afghans and Beloochees to curdle milk. Experiments conducted officially on a farm belonging to the Governor of Bombay have demonstrated the efficacy of the berry in the manufacture of cheese, a perfect curd being produced, and the cheese turning out excellently; and, with a view to the more extended cultivation of the shrub, an experimental plantation is to be established at the Government Botanical Gardens at Saharanpore. The puneria—so called from the Persian name of cheese—is prepared by placing about two ounces of the berries in a small quantity of cold water, and allowing it to simmer by the side of a fire for twelve hours. It is said that half a pint of the decoction will suffice to curdle fifty-five gallons of milk.

"PALMY DAYS."

TO OUR READERS.

THE EDITOR is much gratified at being able to announce that the Proprietors have acceded to a very wide-spread demand for an Extra Holiday Number of CASSELL'S FAMILY MAGAZINE. On the 25th of May will be issued, together with the ordinary monthly Part, but quite independently of that Part, and sold separately, an Extra Holiday Number, under the title of "PALMY DAYS."

"PALMY DAYS," as befits its name and purpose, being a Holiday or Summer Number, will comprise reading of the brightest and most attractive character, as a suitable companion for the country and the sea-side. It will contain as many as nine short complete stories by well-known writers; pleasant, gossipy papers descriptive of nature and human nature at home and abroad; and, in addition, will include the Prize Poem on Happiness, and the Prize Song, "Child Amid the Flowers at Play," to which the Five Pound awards have recently been accorded.

"PALMY DAYS" will be profusely illustrated throughout, and will contain a charming Frontispiece by Davidson Knowles, some clever Character Sketches by Harry Furniss, and the whole will be encased in a specially designed coloured wrapper, so as to suitably distinguish it, in external appearance, from the ordinary Part, published on the same day.

In CASSELL'S FAMILY MAGAZINE for JUNE will be published the opening chapters of a new Serial Story, entitled "Co-Heirs," by John Berwick Harwood, author of "Lady Flavia," "Paul Knox, Pitman," "Ralph Raeburn's Trusteeship," &c.

In the same Part will also be published the Editor's announcement of further Prize Competitions open to all readers of CASSELL'S FAMILY MAGAZINE.

POEM AND SONG COMPETITIONS.

NOTICE TO COMPETITORS.—Owing to the exceptional demands on our space, it has been decided to publish the Prize Poem on Happiness and the Prize Setting of Mrs. Hemans' song, "Child Amid the Flowers at Play," in the Extra Holiday Number of the Magazine, entitled "PALMY DAYS," which will be published simultaneously with our next issue, namely, on the 25th of May. In our ordinary June Part will be published an announcement as to further Prize Competitions.