will not be permitted to carry work home, but must hire workrooms in buildings set apart for that purpose. There is a great deal of good sense in this provision. Dr. Richardson says that work carried into squalid tenements is often a cause of the spread of disease. "I, myself," he adds, "have seen the half-made riding habit, that was ultimately to clothe some wealthy damsel, act as the coverlet of a poor child stricken with malignant scarlet fever." In order to avoid dissemination of disease by soiled linen, public laundries are established under municipal direction, and to these alone must be sent such clothing as is not washed at home. Public hospitals are established in various parts of the city. We have not space to enter into the details of these, and it will be sufficient to say that their planning is the result of Dr. Richardson's long experience in the great city of London hospitals. There are no insane asylums, and no poor houses; the few who would occupy such institutions are to be placed in houses licensed as asylums, but in no wise different from other buildings in the city. No persons are to be "badged and badgered as paupers," the author significantly remarks.

Of course the model city contains baths, gymnasia, public libraries, art museums, in brief all requisites for mental and physical culture. There is a municipal medical staff, under whose supervision every assumable disease and probable cause of disease is subjected to investigation. The sewage is conveyed to a farm and utilized; the water supply is uncontaminated and led always through iron pipes. An immense ozone generator makes ozone, which is "laid on" in private houses for disinfecting purposes. All animals for food and the modes of slaughtering them are under rigid inspection, and the killing is preceded by rendering the brutes insensible by passing them through a "narcotic chamber." Finally, there are no marked graves, no reserved spaces in cemeteries. The dead are buried in wickerwork coffins, which, with their contents, decompose and mingle with the earth. The only memorial monuments are tablets in a spacious covered hall or temple.

Dr. Richardson stops here, for he reaches the confines of his legitimate territory as a sanitarian. His plan, he says, will reduce the rate of mortality to 8 per 1,000 of the inhabitants for the first generation, and to 5 per 1,000 eventually. That this is a vast decrease is obvious when we compare this ratio with that of New York city, where, according to the latest statistics, the weekly mortality averages 82 per 1,000. But need we stop here? Certainly the inventor can step in where the hygeist ends; and may not this model city of health be the model city where are congregated the newest triumphs of inventive genius? There, perhaps, will be located the telegraph which, already in existence, enables us to transmit sound, and so hold converse over long distances, or to lead music into our houses as easily as the water or gas; there will be congregated all those wonderful automatic appliances which reduce the manual drudgery of housework to little more than mere supervision; in those underground railways, we may hope to see speed attained beyond all precedent, yet at no sacrifice of safety; there arms of metal controlled by electricity, by steam, by compressed air, by hot vapor, will relieve arms and muscles of flesh and blood; and then, physical labor being reduced to its minimum, may we not look for that cultivation of the intellectual man which shall lead to still greater attainments? Will not means be devised for developing our dual brain? May we not hope to use our left hand as easily as our right, our feet as advantageously as our hands, in all species of that which is now called handiwork? And then what higher race of men will be evolved by heredity, surrounded by such environment? Is not Dr. Richardson's Hygeia, after all, but the first step toward the rapid development of the future perfect man?

MINERALS AT THE CENTENNIAL.

Much disappointment has been expressed by many in not finding a better display of American minerals at the Centennial. We take an honest pride in the natural productions of our country, and perhaps we had expected too much of it, and hence the disappointment. Another cause of disappointment lies in the arrangement; there are a great many fine minerals scattered here and there, all over and in all the buildings, which, if brought together and systematically arranged, would make a fine show. The present arrangement, which is geographical, is of course the best for exhibitors, for each State and country gets due credit for what she exhibits; it is also the best for any one wishing to learn what may be the mineral wealth of a given State; it is interesting to those about to emigrate; but for the student of mineralogy, the order followed in our museums and technical schools is better.

THE MINERAL ANNEXE.

If we enter the mineral annexe at its eastern extremity, and pass down towards the Chinese exhibit of teas, figures, and curiosities, we find ourselves in the section devoted to the various States, beginning with that of Illinois. This State makes rather a poor show of minerals, with the exception of lead ores, especially of galena, of which there are some fine crystals, also calcite. The collection of antiquities from this State is, however, very fine. Next we see a large block of crude native sulphate of soda (Glauber's salts), some 4 feet square, from Wyoming territory. This block was taken from a deposit of 100 acres in extent and 10 feet thick, and appears to be quite pure. Pennsylvania follows, and its exhibit consists mostly of coal, iron, and oil, with some geological models, and a series of preparations made by Professor Schorlemmer, of Owens College, Manchester, England, illustrating the composition of petroleum.

Michigan is next, and far exceeds in interest any of the above. Her specialties are native copper and silver, which are well represented here. First we see a cubical mass of copper, 3 feet on a side, which has been cut from a mass weighing 76 tuns. Then we have ancient stone tools used by a prehistoric race for working the copper: copper minerals of different kinds; a conglomerate containing 5 per cent of copper; a large number of chlorastrolites, a green mineral peculiar to the Lake Superior region; native silver, and a set of miniature tools, like those now used in copper mining, made from the native silver and copper just as it comes from the mine; iron ore, and a geological section of the iron district; lastly an Indian canoe 10 feet long, made of birch bark.

The next State is Missouri, where lead and zinc abound. Here are some coal fossils of *lepidodendron*, also malachite, azurite, kaolin, geodes of amethyst, and other minerals. The zinc ores, from Dade county, and blende, from Joplin and Graten, are especially worthy of notice.

Ohio is chiefly noticeable for the mound builders' relics, a very large and fine display being made by the State Archæological Association, and another by L. M. Hoseas, of Cincinnati. Some of these indicate the possession of considerable skill and taste on the part of the extinct race that once inhabited that region. The building stones of the State are shown in the Ohio State building.

Next in order is Wisconsin, with her iron, lead, zinc, and copper. Here is a huge mass of smithsonite, or carbonate of zinc, which the miner calls dry bone, from its peculiar appearance. Here, too, are tools made of stone and of copper, which carry us back to prehistoric races.

Iowa is chiefly noted for its display of coal and lead. The geological formation is illustrated by a cabinet in which thin strips of the rock in each strata are placed one above the other, in cases 6 feet high and 18 inches wide. There are 12 of these cases, in which are shown all the various formations, from the St. Peter's sandstone up to the drift. Here for the first time are seen some skulls of the mound builders, also some large geodes.

Indiana exhibits kaolin in large quantities, also coal and iron ore. Delaware also exhibits iron and kaolin. The Schuylkill Company exhibit a block of coal weighing 14 tuns 13 cwt., in this annexe, and here, too, is some statuary marble from Rutland, Vt., with photographs of the quarries. It seems surprising that so few mines, mills, or quarries have thought it worth their while to procure photographs of their works, for they both attract attention and impart, in an easy way, a deal of information.

The west end of this annexe is devoted to the Chinese and to some process for making artificial stone, by the aid of steam and carbonic acid.

In the smaller mineral annexe is a cabinet, showing a section, in miniature, of the Warrior coal measures of Alabama. The South Carolina exhibit embraces a model of the washers used in preparing nodules of phosphate of lime mined by the Charleston Mining Company on the Ashby river, S. C.

The most attractive exhibit in this building is that from Mount Union College, Ohio. It embraces a gorilla from Western Africa, a koala from Australia, an ant eater from Brazil, a kangaroo rat from Australia, and a *galeopithecus* from the Philippine Islands.

A few States, including Kentucky and Tennessee, have their exhibits in the United States Government building; others, New York among the number, have none worth mentioning. Kansas and Colorado have their minerals with their other products, including Mrs. Maxwell's animals, in their own State building. Colorado is particularly rich in minerals, and an enterprising dealer has constructed some toilet or jewel boxes, which he has covered with Colorado minerals, and these he sells in large numbers at the Colorado building. The prettiest of these minerals is the green felspar, known as amazon stone, which is found almost exclusively at Pike's Peak. Silver ores in abundance are also shown here, as well as tellurium minerals and many others less valuable or beautiful. About the door lay huge masses of silver ore and bituminous coal.

THE MAIN BUILDING.

Returning to the Main Exhibition Building, we find there a collection of Rhode Island minerals, very creditable to that little State; also some interesting relics, arrow heads, hatchets, etc., from the same State. There is a pretty good collection of Californian minerals, said to contain 17,000 specimens, number of species not stated.

From Maryland, we have some handsome *verde antique* marble, chromic iron sand from Delaware county, Pa., and crystals of bichromate of potash made from it.

The Passaic Zinc Company, of New Jersey, exhibit some fine specimens of calamine, also zincite and willemite, together with the metal made by them from these ores. The Corroding Lead Company exhibit pigs from the furnace, refined, soft, and desilverized lead, flake litharge, slag, skimmings, dross, regulus from matt, etc.

Joseph Wharton, Camden, N. J., makes the best and almost the only exhibit of nickel ores, ordinary nickel ore, pyrrhotite and millerite, and a set of salts, anodes, etc.

Not far from here is a model of a portion of an anthracite colliery, the Warton vein, Beaver Brook Pa., on a scale of 30 feet to the inch. The superincumbent strata being partly removed, the coal bed is exposed, showing the dip, synclinal, anticlinal, slopes, galleries, coal breakers, and other important parts, carefully labeled and intended for educational use.

There is a curious stone here from Mumford, Munroe county, N. Y., which consists entirely of vegetable petrifactions, chiefly leaves and twigs. Although it looks very fragile, it must possess considerable strength, for we are told that a church has been built entirely of this stone. Adjoining this is a large mass of infusorial silica, the so-called electro-silicon, from Nevada. This substance consists entirely of the siliceous remains of microscopic animals, and presents, when viewed under the microscope, many beautiful forms. Its chief uses are in the manufacture of dynamite, and as polishing powder.

Adjoining this again is a large and beautiful collection of American minerals, with a few foreign ones, exhibited by Professor A. E. Foote, of Iowa. Most conspicuous among these is the green amazon stone from Pike's Peak, Colorado. Then come some very powerful natural magnets, from Magnet Cove, Ark., a great variety of quartz crystals, single and in masses from the Hot Springs, a crystal of smoky quartz which is four feet long, from Pike's Peak, rose quartz, amethyst, petrified moss, green wavellite (unusually fine), native copper, petzite, stalactites and stalagmites, agates, landscape marble, etc. There is also a set of specimens put up for students' use, which embraces many rare minerals, and yet comes within the reach of almost every one.

In a cabinet by itself is a collection of minerals from the line of the Texas and Pacific railroad, also collected by Professor Foote. The most beautiful or rare are the turquoise and embolite (chromo-bromide of silver), from New Mexico, sylvanite (telluride of gold and silver), from Colorado, and moss agate, from Texas.

Iron and coal, as well as the precious metals, have been treated of elsewhere from an economic point of view; but we cannot refrain from calling attention to an unusually large, hollow mass of hematite iron ore, which constitutes a small cave with jet black walls, that look as if they had been varnished.

THE UNITED STATES GOVERNMENT BUILDING.

Carefully guarded in a fireproof safe are several of those exceedingly rare crystals, namely, pure gold. Not far from these are specimens of silver ore, valuable but not very beautiful, from Comstock and other celebrated lodes. Here, too, are many fine specimens of the purest sulphur, borax in abundance, and many other things which will be very valuable when civilization, now on its western march, shall have reached their hiding places. We also notice some large aerolites.

In cases against the walls are arranged some loan collections worthy of notice, especially those of Messrs. Jefferis, Perry, & Wilcox, of Philadelphia. One crystal of apatite, 4 or 5 inches long and 2 inches thick, was quite unequaled anywhere else. Mr. Fletcher makes a creditable exhibit of minerals from Bergen Hill, some of which are very beautiful.

CANADA.

The Canadian mineral exhibit is in the Main Building, and has been pronounced by competent judges one of the best on the grounds. Apatite, amethyst, native copper, iron, coal, and oil really deserve more notice than our space at present permits.

FOREIGN EXHIBITS.

Of the South American countries, Chili stands first. The collection of Emilio Escobar, embracing 445 specimens, is valued at $30,000. It consists chiefly of native silver and silver ores, including several specimens of beautifully crystalized proustite or ruby silver (sulphide and arsenide of silver), from Chañarçillo. Some of the crystals are over 3 inches long; the finest specimen is valued at $4,000. The copper minerals are also very beautiful, especially the atacamite (chloride of copper), malachite (carbonate of copper), and many others; also cobalt ores, borates, sulphur, cinnabar, etc. The process of amalgamating silver ores is exhibited in a separate building, near the glass house.

Brazil and Mexico make a very fair show. The Mexican marbles, from their rare beauty, attract much attention. A single mass of metallic silver 6 feet in diameter, weighing 4,002 lbs., and worth $72,000, attracts much attention from its value.

Russia is the only European country whose mineral exhibit fairly represents her mineral wealth. The exhibit from the Museum of the Imperial School of Mines is very fine. Beginning with native platinum and its associate metals, palladium, rhodium, iridium, ruthenium, etc., we next see some beautiful specimens of *aqua marina*, a bluish-green variety of beryl, emeralds, garnets, and zircons. Ouvarovite, an emerald green garnet, named after the Russian minister Uvarof, large pieces of jasper, nephrite, and topaz, in crystals 6 inches long, are some of the curiosities of the collection. The crystals of pure white rock salt, and of mica, are worthy of notice. Malachite, *lapis lazuli*, rhodonite, and labradorite, the great Russian specialties, are represented here; but a much finer display is made by Hoessrich & Woerffel, who exhibit a large number of articles made from these beautiful stones, such as vases, table tops, cabinets, mantlepieces and jewelry.

Practical Germany limits her mineral exhibit to products of use in the arts: amber, lead ores, petroleum, and Stassfurt salts. The collective exhibit of potassium and magnesium salts from Stassfurt is very complete, tastefully arranged, interesting, and instructive. Their discovery has created a revolution in the alkali industry, and it is now no longer necessary or profitable to destroy fine forests to obtain our supply of potash.

Great Britain makes a very poor show. Some bricks and tiles, chalk and cement, some polished granite from Aberdeen, and we have done. Italy is rather better, for she exhibits a fine collection of polished marbles, besides sulphur and alabaster.

The exhibit of Hawaii, although small, is very interesting, embracing as it does several sets of volcanic minerals and

lava from the crater of Kilaura. Among these is a bird's nest, made of pelee's hair, a substance resembling our mineral wool, and formed in an analagous manner, by the wind blowing over melted lava.

Diamonds in the rough, and diamondiferous soil with a diamond in it, are shown in the pretty little exhibit of the Orange Free State.

There are a few minerals scattered about elsewhere, but none of much value

CENTENNIAL NOTES.

The Siamese exhibit, which has been six months on the way to the Exposition, has arrived, and is located in the Navy Department section of the Government Building. The collection was made under the direction of the King of Siam, and is a present to the United States. Whatever mighthave been its original condition, the present state of that portion of it which is visible is sad to behold. Under a covering of canvas there lie bundles of apparently broken parts of wa gons, a couple of rude wheels, dried palm leaves and other vegetable products, and a countless number of *et ceteras*, massed together and seemingly defying any attempt to resolve them into order. On the tables near by are displayed several curious peaked and pointed head dresses covered with spangles and gilding, and a collection of models of the long low snake-like boats peculiar to the Malays. All are tarnished and dingy, and the marks of a severe voyage and not over gentle handling are everywhere apparent.

THE GERMAN EXHIBIT

was so mercilessly criticised in the letters sent home by Professor Reuleaux, the chief German commissioner, that it has become rather the fashion to speak slightingly of the display as a whole. This is decidedly unjust, for there are very many admirable features, amply sufficient to compensate for the over-abundance of effigies of Kaiser William and Bismarck, and the exhibit of cheap jewelry and chromos. For instance, there are Count Wermgerode's reproductions, in cast iron, of many famous works of art. These consist of helmets, shields, sword hilts, pitchers, urns, and plates, covered with exquisitely molded figures in bas relief. The casting is remarkable for its perfection in details, and will be quite a revelation to most foundrymen. One plate is left just as it was taken from the mold, with much of the sand still clinging to it, and the sharpness of outline attests the excellent work of both molder and founder. The objects are finished with a coating of brown powder, so that they cannot be distinguished by the eye from real bronze, while their cost is of course much cheaper. The ivory display is also very fine. Above the tall ebony case in which the objects are placed is a large pair of elephant's tusks, surrounded by smaller tusks, graduated according to length, and terminating in the short tusks of the walrus. Within the case are pianoforte keys, billiard balls, combs, chessmen, and a handsome collection of carved articles. A curious species of ivory is also exhibited in the long straight spiral horns of the narwhal or unicorn fish of the northern seas.

Germany gives to her pottery from the Royal Porcelain Manufactory, Berlin, the post of honor in the center of the building. To describe this superb display is scarcely possible, since the exquisite delicacy and artistic coloring of the ware render each piece an object of high art. Many of the vases are of very large dimensions, indicating the great skill brought to bear in their molding. The chemical exhibit in the German Department we have already described in other articles. Perhaps the most instructive contribution in the whole large display is one of the coal tar distillates and aniline colors, so arranged as to show the progress of invention in drawing from the dull heavy coal tar its oils, and then the beautiful shades of red, violet, blue, green, and orange, and finally that great triumph of the chemist's skill, alizarine or artificial madder, which surpasses the true madder root in brightness and fastness of color. The success which so far has rewarded investigators leads to the belief that the problem of manufacturing artificial indigo will be solved. One of the latest discoveries in the field of coal tar colors is eosine, which promises to supersede the costly cochineal.

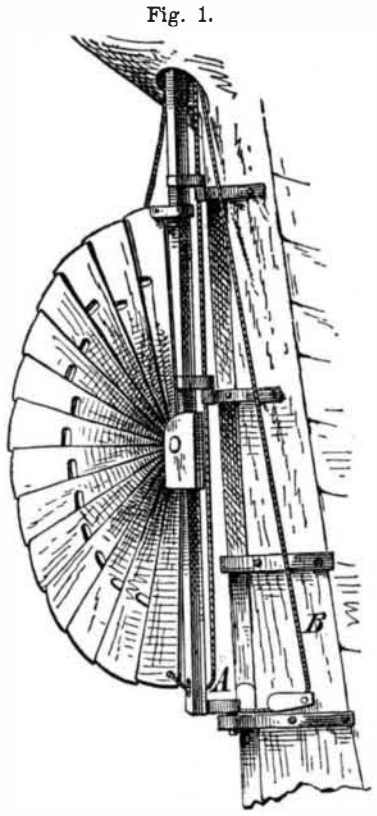
There are three exhibitors of paraffin and mineral oil manufactured from peat. This industry is, in Germany, confined to Saxony, and the total annual value of the product is about $4,000,000. The oils are mainly used for lubricating purposes, the poorer sorts alone being employed for the manufacture of illuminating gas and stearine candles. One very large block of stearine is exhibited, which is nearly a pure white A large display is made of the famous Johann Maria Farina cologne. The descendants of Farina claim to be the only possessors of the secret of making the perfume. We shall describe other interesting German articles in future articles.

In the Italian section there is a model of

A NEW JURY RUDDER,

a sketch of which, Fig. 1, we give herewith. It is always customary for vessels to carry to sea the material for making a temporary rudder in case that very important appendage should become disabled, and there are many ingenious inventions for putting together spare spars and pieces of timber in rudder form. When the new rudder is made, however, the difficulty is by no means surmounted. The problem then is how to get it in place; and when a ship is rolling heavily in the trough of the sea, this is an exceedingly troublesome and perilous operation. The plan proposed by M. Raffaelle Cagliesi, of Ancona, offers first a simple construction, which is such that the device may be folded into a very small space, and so easily stowed; and, second, an easy means of shipping the rudder. The appliance is made of heavy iron plates pivoted, like a fan, to a recessed block of metal at the center of an iron post, A. The upper plate is fast to the post and the others may be folded up beside it, so

Fig. 1.



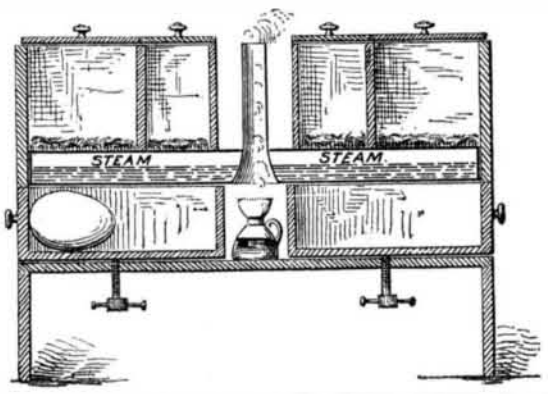
that when the device is thus placed it may be passed downward through the rudder hole. On the post are pintles which slip into gudgeons on the stern post, thus hinging the rudder in place. And also on the stern post is a sheave, B, through which a chain or rope is kept passed; so that, when it is necessary to place the rudder in position, one end of this rope is attached to the lower pintle, and by pulling on the other end the pintle is quickly drawn into the socket. In the lower part of the post, A, there is a sheave through which another rope, attached to the lower rudder plate, is rove, and which likewise leads up through the rudder hole By pulling on this after the rudder is placed as described, the fans or plats are expanded as shown, while they may be closed to remove the apparatus by means of a rope shown on the opposite side.

In previous articles we have described the growing South African industry of ostrich raising, which, it has been suggested, might be successfully carried on in this country. In the annexed engraving is represented

THE LEVIATHAN INCUBATOR

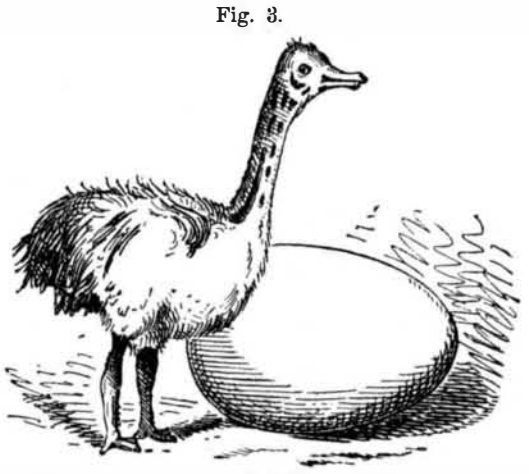
(exhibited in the Cape of Good Hope section), wherein the huge eggs are hatched. The apparatus consists of a middle steam chamber of metal (Fig. 2), which is kept constantly

Fig. 2.



hot by a lamp or furnace beneath. Below this are drawers in which the eggs are first placed, and these, by means of the screws shown below, may be raised until the eggs are brought almost in contact with the warm surface above. In these receptacles the eggs are kept for two weeks at a temperature of 102° Fah. They are then removed and placed in the inner pair of compartments, shown above, for another

Fig. 3.



fortnight, at a temperature of 100°. At the end of this period the eggs are carefully extracted, and a small hole is chipped in each shell at the point opposite the chick's head. They are next replaced and kept in the same compartments for two weeks longer at 98°, when the hatching takes place, and the young birds are placed in the outer upper receptacles, and there remain for two days. The compartments above, it should be noted, have bottoms of lamb's wool, which come in contact with the steam chamber below.

The two days' old chick is also represented in the engraving, Fig. 3, beside an egg, so as to show the relative size. The egg is about 7 inches in length and the bird some 13 inches in hight. The chick is fed on rice, and when it reaches the age of seven days is worth $50 in gold. Nearly 20,000 birds, we are informed, have been hatched at the Cape of Good Hope by apparatus of this description. The machine is frequently made of sufficient size to hold 115 eggs at a time.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the object mentioned. M. M.

Positions of Planets for November, 1876.

Mercury.

Mercury should be looked for before sunrise during October and the first half of November. On November 1, it rises about 5 A. M., and sets at 4h. 15m. P. M. On November 30, Mercury rises at 7h. 4m. A. M., and is too near to the sun to be seen.

Venus.

Venus is still brilliant in the morning, rising on the 1st at 2h. 58m. A. M., and setting at 3h. 15m. P. M. On the 30th, Venus rises at 3h. 58m. P. M., and sets at 2h. 45m. P. M. Although its apparent diameter is much smaller than in the summer, it is still a very beautiful object, and can be seen all through the month. On the 28th, Mars, at this time very small. can be recognized by its nearness to Venus.

Mars.

Mars is one of the planets visible to the naked eye, but it is very small in November, and can be seen only in the morning. It may be known from the circumstance of its keeping nearly the same diurnal path with Venus, at a little less altitude.

Mars rises on the 1st at 4h. 14m. A. M., and sets at 3h. 47m. P. M. On the 30th, Mars rises at 3h. 56m. A. M., and sets at 2h. 37m. P. M On November 28 Mars and Venus will have nearly the same right ascension, and will pass the meridian with only a few minutes difference of time.

Jupiter.

Jupiter is very little seen in November. In the early part of the month it sets about 6h. 10m. P. M., and can be seen in the southwest immediately after sunset. On the 30th, it rises at 7h. 26m. A. M., and sets at 4h. 39m. P. M.

Saturn.

Although Saturn is low in altitude (in this latitude not above 26° for the whole month of November) it is much the most interesting object in the evening sky. With a telescope of low power, its wonderful ring can be seen, and at least one of its many satellites. On the 1st, Saturn rises at 2h. 16m. P. M., comes to the meridian at 7h. 30m., and sets at 43m. after midnight. On the 30th, Saturn rises at 23m. after noon, comes to the meridian at 5h. 38m., and sets at 10h. 53m. the next day. Saturn is among the stars of *Aquarius*, but so much brighter than even the brightest of the constellation as to be readily known to be a planet.

Uranus.

On November 1, Uranus rises a few minutes after midnight, but a short time before the bright star Regulus, and 1½° north of it in declination. The planet can perhaps be found by its nearness to this bright star; it approaches the star until the 29th. On the 30th, Uranus rises at 10h. 15m. P. M., and sets at 11h. 58m. the next morning.

Neptune.

Neptune rises on November 1 at 4h. 41m. P. M., and sets at 6h. 1m. of the next morning. On the 30th, Neptune rises at 2h. 45m. P. M., and sets at 4h. 3m. the next morning. This planet is so far distant from the earth that it can be seen only by means of the best telescopes.

Sun Spots.

The report is from September 28 to October 17, inclusive. The photographs of September 28 and September 29 show two large groups of spots coming on. These were seen till October 3; but after that date, clouds prevented observation and photographing till October 9, when the sun's disk appeared to be free from spots. On October 13 a group of small spots was seen on the western limb. These had not been discovered before, probably on account of clouds. This group was last seen on October 17, but, contrary to the usual behavior, it had appeared to increase in size as it approached the limb. The return of this spot may be looked for after two weeks.

Small Arms for Russia.

Smith & Wesson, Springfield, Mass., have a new contract with the Russian government for 20,000 pistols, which are to be the same as those they have making, and include the automatic ejector. The firm have now manufactured some 130,000 for this government, their first contract being taken in 1871. This contract, by the way, was concluded for the government by a gentleman bearing the euphonious name of Captain N. Kouschavewitsch.

THE Australian gum tree, *eucalyptus globulus*, well known for its antiseptic qualities, has recently been found to yield a fragrant resinous oil, containing a substance homologous to camphor.