Germany's Two Great Coal Regions.

BY H. L GEISSEL.

Prof. Schulz, German Privy Councilor of Mines, and a recognized authority on European mining matters, has just given out some interesting figures on the coal deposits of the two great German mining districts. Prof. Schulz says that the Rhenish Westphalian mining region extends over an area of 60 square miles. To a depth of 700 meters there are yet available and exploitable 11,000,000,000 tons of bituminous coal; from that depth to 1,000 meters there remain 18,300,000,000 tons; and in the depth between 1,000 and 1,500 meters, well accessible under present mining conditions, there are another 25,000,000,000 tons, or, altogether to the last-named depth of 1,500 meters, 54,300,000,000 tons. Prof. Schulz expresses the opinion that science will improve our present means to such a degree that in time it will be possible to safely carry on operations at a greater depth than 1,500 meters, whereby another 75,000,000,000 tons of coal would be obtainable. Thus, the total quantity of coal still buried in the Rhenish Westphalian district amounts to 129,300,000,000 tons. Supposing the future annual output of the district should average 100,000,000 tons—that is to say, about twice the present output—the coal deposits available down to a depth of 1,000 meters would still last for 293 years, and to 1,500 meters for 543 years.

The second coal region, the Upper Silesian, is even larger. Here the carboniferous mountains reach a depth of 7,000 meters, on an area of 2,162 square miles, and the 114 workable layers have an average thickness of 170 meters. When calculating the quantity of coal workable to a depth of 1,000 meters, it must be taken into account that the carboniferous mountains generally are covered by younger layers about 200 meters in thickness, and that, when carrying on operations to a depth of 1,000 meters, about 33 1-3 per cent has to be deducted for safety constructions, loss, etc. There would thus remain, according to Prof. Schulz's estimates, a quantity of 62,800,000,000 tons of workable coal down to 1,000 meters. During the period from 1748 to 1900 there have been extracted 500,000,000 tons, thus leaving 62,300,000,000 tons to be mined. According to the Upper Silesian mining returns, the increase in the output from decade to decade has been 43.5 per cent. In 1899, when the deepest shaft was but 594 meters, the output amounted to 23,500,000 tons. Supposing that it reaches within 50 years three times the present output, the deposits down to 1,000 meters would last for 890 years, and would probably not be exhausted until the year 2790. At a depth of 1,000 to 1,500 meters there are further available 101,550,000,000 tons, and from 1,500 to 2,000 meters another 140,800,000,000 tons, the mining of which would require 1,450 and 2,000 years respectively. But, even at that time, there would yet be immense quantities of coal available, as huge deposits extend over the mountains deeper than 2,000 meters.

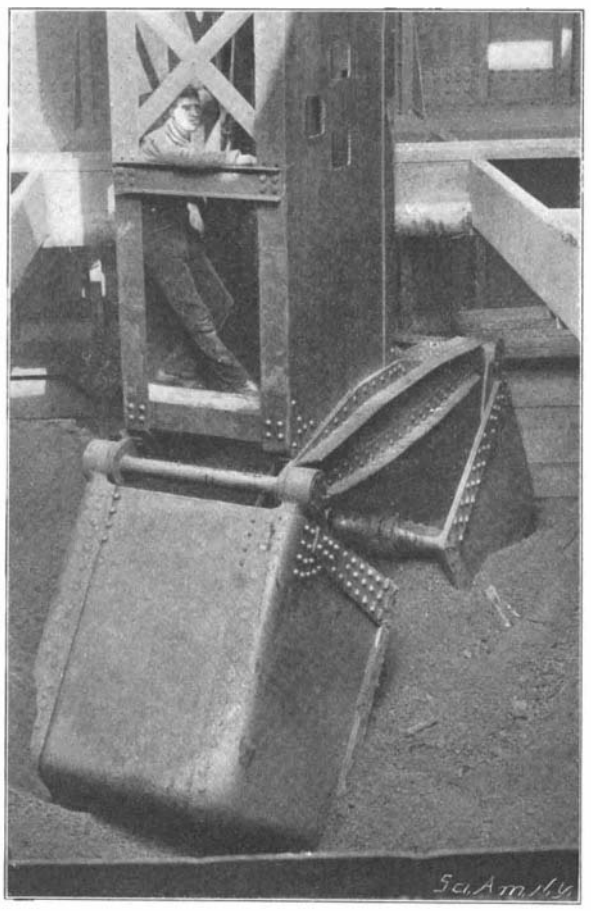
How the Welsbach Mantle is Made.

The "mantle" of the Welsbach light is an ash consisting mainly of the oxides of certain rare metals—lanthanum, yttrium, zirconium, etc., which are rendered incandescent by heating to a high temperature. A six-cord cotton thread is woven on a knitting machine into a tube of knitted fabric of a rather open mesh. This web has the grease and dirt thoroughly washed out of it, is dried and is cut into lengths double that required for a single mantle. It is then saturated in a solution containing the requisite oxides, wrung out, stretched over spools and dried. Next, the double-length pieces are cut into two, the top of each piece is doubled back and sewed with a platinum wire, which draws the top in and provides a means of supporting the mantle, when finished, from the wire holder. After stretching the mantle over a form, smoothing it down and fastening the platinum wire to the wire mantle holder, the mantle is burned out by touching a Bunsen burner to the top. The cotton burns off slowly, leaving a skeleton mantle of metallic oxides, which preserves the exact shape and detail of every cotton fiber. The soft oxides are then hardened in a Bunsen flame. A stronger mantle is made upon lace-making machinery.—The Keystone.

AUTOMATIC ORE UNLOADER.

BY W. FRANK M'CLURE.

Three great automatic iron ore unloaders, the first of their kind in the world, will be in operation upon the docks of the Carnegie Company at Conneaut, Ohio,



THE SCOOP GATHERING UP ITS LOAD.

Harbor the coming season. The complete success of these machines will mean their general adoption along the Great Lakes, and, incidentally, the realization of the fondest hopes of many of the big dock companies. Their use at all the ports will revolutionize the ore-handling industry.

For years pessimists have prophesied that a successful automatic iron ore unloader was an impossibility. Futile attempts to build such a machine have been made from time to time in the past decade. The announcement, therefore, that Andrew Carnegie was to build an automatic ore unloader at a cost of $100,000 occasioned no little interest.

On completing the first machine some time ago it was found necessary to rebuild it. Additional bearings in particular were found to be needed. Each test of the machine has been more satisfactory than the former one, and when last year the Carnegie Company ordered two more machines of the same pattern completed for this season's business, at a cost of $100,000 each, it was apparent that the steel king felt sure of their success. The three machines have now been completed. The accompanying photograph shows them, side by side, each in operation but in different positions.

The total weight of the first machine was found to be 400 tons and its height 55 feet. The all-important part of the machine is the bucket, which grasps ten tons at a single lift, or ten times that lifted by the largest ore bucket previously used. This great bucket is attached to a revolving pending leg, which in turn swings from a long and gigantic arm. This arm is carried forward and back upon a track, to a point above the vessel when the bucket is to be filled and to a point above the car when the bucket is to be dumped.

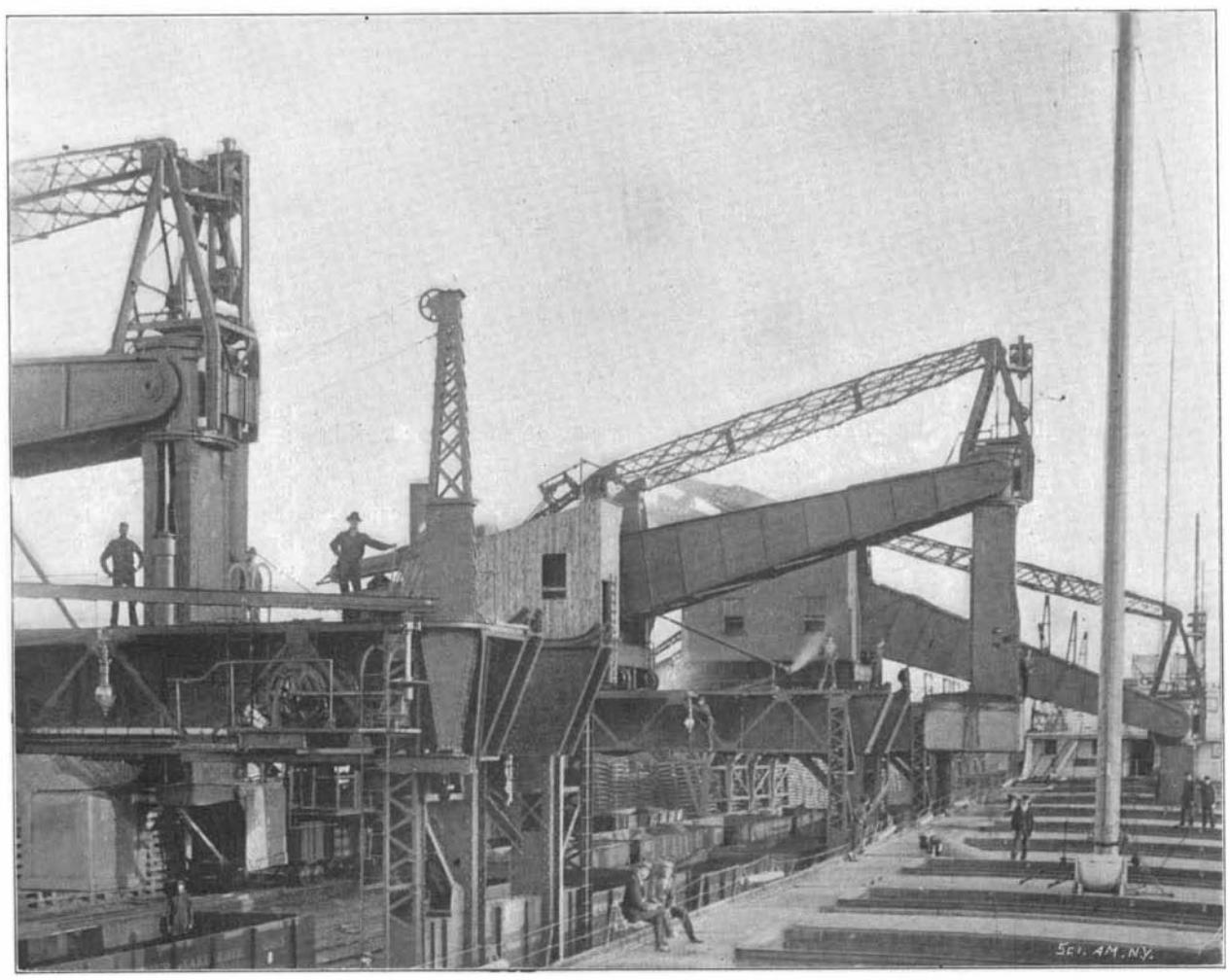
The bucket is first lowered part way into the vessel's hold. Next the scoop is opened and then lowered until it strikes the ore cargo and sinks deep into it. When open, the bucket has a spread of nineteen feet. The scoop is closed upon the ore by hydraulic power. It is then ready to be raised and conveyed to a point over the car into which the ore is to be dropped. Where the ore is to be placed on the stock piles, it is dropped into a trolley car which will convey it.

The automatic ore unloader is expected to take out from 90 to 95 per cent of the ore in a vessel. The bucket when below the hatch of a vessel can be swung around lengthwise, in which case it reaches about nine feet from the edge of the hatch in either direction. The small amount of ore which cannot be reached by the scoop is shoveled by hand to a point within its grasp.

In the accompanying photograph showing three machines, the big scoop or bucket of the machine in the distance is below the hatch of the vessel, reaching into the ore. The scoop of the next machine is raised to a point above the vessel, and the view nearest the reader shows the scoop after it has been conveyed and the contents dumped into a railroad car.

Four machines, side by side, can be used in the average vessel at one time. Each machine is expected to remove 300 tons of ore per hour when fully perfected. Four machines, thus unloading 1,200 tons per hour, would empty the largest vessel on the lakes in a comparatively short time. The largest cargo of ore hauled last year on the Great Lakes aggregated 7,446 gross tons. If such rapid handling of iron ore can be secured, the work of many men will be saved. One of the ore unloaders can be operated by six men. Three of this number remain in the vessel to shovel ore within the reach of the scoop. Three operate the machine. With four machines working in a vessel twenty-four men would thus do the work which usually requires 100 men.

As yet no attempts have been made to establish speed records. Otherwise the tests are reported to be very encouraging. George H. Hulett, a mechanical engineer of Akron, Ohio, is the inventor.



POWERFUL AUTOMATIC ORE UNLOADER IN USE, SHOWING DIFFERENT POSITIONS OF THE MAIN ARM AND BUCKET.

The Sunflower.

Dr. Harvey W. Wiley, Chief of the Division of Chemistry, United States Department of Agriculture, in a special report shows that the sunflower can be grown successfully over large areas in the United States; that it is a crop which makes a considerable drain on the elements of soil fertilizers; that one of the most valuable constituents of the plant is the oil, which exists in large quantities in the seeds; that the economic production of the sunflowers is now confined almost exclusively to Russia, where it is an agricultural industry of considerable importance; that in the United States it is grown as an ornament and for the production of seeds, which are used chiefly for poultry and bird feeding and for condimental and medic-

inal properties with farm animals; that the oil of the sunflower seed is not produced commercially in the United States; and that in the cultivation of the sunflower the methods pursued for growing Indian corn are to be followed, and the plant is capable of cultivation over almost as wide an area as Indian corn.

A PAIL FOR LIVE BAIT.

Every fisherman knows how difficult it is to keep minnows alive. If the fish are kept in a pail, the water must be constantly changed to furnish a new supply of oxygen. The difficulty thus presented of

A NOVEL LIVE-BAIT PAIL.

feeding sufficient oxygen to enable the fish to live not only for hours, but for days, has been very ingeniously overcome in an invention for which Mr. Cassius M. Fisk, of Napoleon, Ohio, has taken out a patent.

Mr. Fisk's invention is a pail which is provided with an air-chamber in its bottom and with a hand-pump secured to the side. The lower end of the pump-cylinder communicates with the air-chamber by means of a pipe; and the air-chamber communicates with the body of the pail by means of a flexible pipe. The pail having been filled with water and the minnows placed therein, the hand-pump is operated to fill the air-chamber with compressed air. Such is the pressure that the air is spontaneously supplied to the fish in the water through the flexible pipe. It is necessary to pump fresh air into the chamber only at very long intervals; for the construction of the flexible pipe is such that the air is very gradually discharged.

The inventor assures us that he has subjected his device to most severe tests. Forty fish, among them minnows so delicate that they cannot ordinarily be kept alive for more than ten hours, were placed in the pail and supplied with air in the manner described. So efficient was the apparatus that after twelve days the fish were all alive, although the water had not been changed during the interval and had become very foul. When the supply of air was at that time cut off, the fish came gasping for oxygen to the surface. The same minnows could not be kept alive in the same amount of fresh water for more than fourteen or fifteen hours.

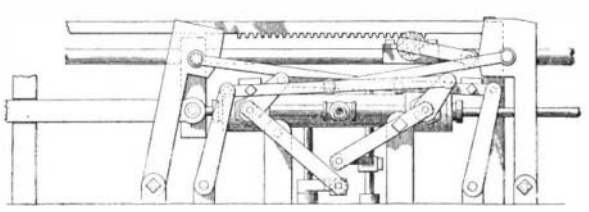
New Compounds of Cobalt.

M. Ducru has recently presented to the Académie des Sciences the results of a series of experiments in which he has formed several new compounds of cobalt. If to a solution of cobalt containing ammoniacal salts and a sufficient proportion of free ammonia is added arsenic acid or a soluble arseniate, a gelatinous precipitate, very voluminous, is seen to form, its color being more or less violet. At the ordinary temperature these precipitates are not modified, but if the flask containing the liquid and precipitate is kept near the boiling point in a water bath, the precipitate is slowly modified; it contracts and is transformed into another of a rather dark red which microscopic examination shows to be entirely crystallized. The duration of the experiment is variable; with concentrated solutions in the proper proportion it may take but a few minutes, but with weak solutions as long as 100 to 150 hours are required. The crystalline compounds thus obtained are cobaltous salts; under the microscope they are seen as needles grouped in clusters, and sometimes in rhomboidal plates. They have a marked action upon polarized light, and belong to the clinorhombic system. They are insoluble in water and weak ammoniacal solutions, but easily soluble in the mineral acids. At the ordinary temperature they lose ammonia, but very slowly. These compounds, which M. Ducru has thus obtained for the first time, are ammoniacal arseniates of cobalt, but their composition varies. While the proportion of cobalt and arsenic is practically the same for all these products, that of the ammonium may vary from zero to 8.6 per cent. It is not the proportion of ammoniacal salts in the solution, but the amount of free ammonia which determines the proportion. The superior limit is reached when the liquor contains 350 per 1,000 of ammonia (20 per cent strength) or 69 parts by which of NH_3. The salt obtained under these conditions is a tri-ammoniac arseniate of cobalt, having the formula $(As\ O_4)_2\ Co_3 + 3\ NH_3 + 5\ H_2\ O$, which approaches the zinc salts obtained by M. Bette. On the other hand, the action of this salt upon the salts of cobalt in presence of ammonium salts (without free ammonia) gives a pale rose salt, crystallized in fine needles, in cotton-like clusters. This salt contains no ammonium, and its composition $(As\ O_4)_2\ Co_3 + 8H_2\ O$, is that of natural erythrine; the crystalline form and grouping are the same. M. Ducru has isolated two of these salts which lie between erythrine and the first mentioned compound; the mono-ammoniac salt $(As\ O_4)_2\ Co_3 + NH_3 + 7H_2O$ is formed when the solution contains 15 per 1,000 of free ammonia, while the di-ammoniac salt $(As\ O_4)_2\ Co_3 + 2NH_3 + 6H_2O$ is obtained at a concentration of 60 per 1,000. The four salts thus obtained appear to be distinct compounds and not mixtures. The experimenter intends to describe a similar series of nickel salts and also a new method of analysis for arsenic which is based upon these experiments.

A VALVE MOTION FOR SMALL HIGH-PRESSURE PUMPS.

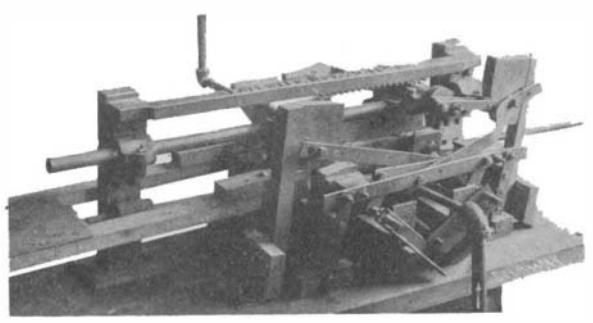
The use of high pressures with pumps of small dimensions presents difficulties, as the valves are liable to be kept open by the pressure. To overcome this drawback, Adolph Richter, 1138 First Avenue, Manhattan, New York city, employs a special device for pressing the valves firmly against their seats during the time they should remain stationary, the valves being released shortly before they are to be shifted.

The valves are turned by means of the levers shown at the end of the elevation, each lever being connected with one suction valve and one delivery valve by links and crank arms. These levers are struck periodically by an arm on the front end of a shaft which is journaled in a slide moving together with the pump piston and provided with a pinion rolling on a stationary rack. This same shaft carries at its rear end another



SIDE ELEVATION OF THE VALVE-GEAR.

arm which at the end of each stroke operates a set of toggle levers connected with spring arms exerting an axial pressure on the valves when the toggle levers are in line with each other. The parts are so timed in operation that the axial pressure on the valves is relieved before they are turned, and after they have



PERSPECTIVE VIEW OF A ROUGH MODEL OF THE VALVE GEAR.

been turned they are pressed against their seats tightly, thus allowing high pressures to be obtained without danger of leakage.

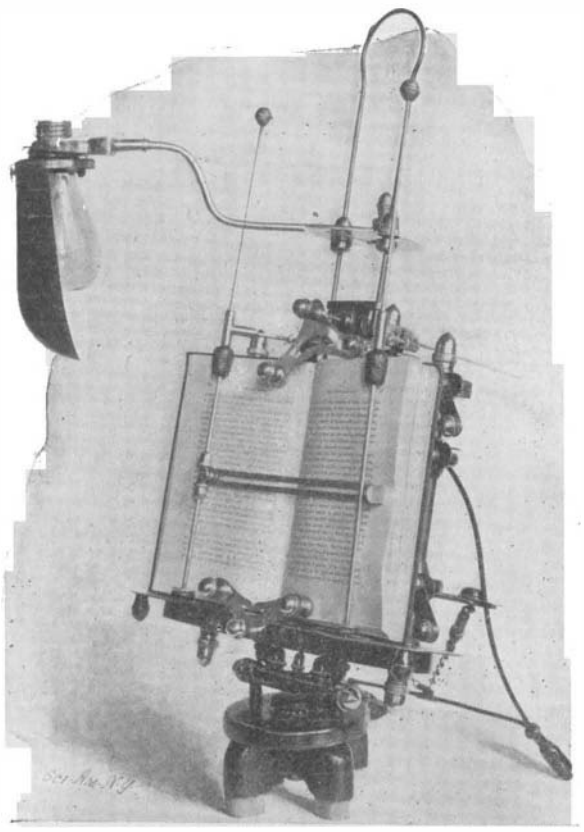
The Bressa Prize.

The Académie Royale des Sciences de Turin announces that a Prix Bressa of 9,600 francs ($1,920) is open to competition among investigators and inventors of all nationalities. The prize will be awarded to the person who, in the opinion of the Academy, made the most brilliant or useful discovery in the four years 1897-1900, or who produced the most celebrated work in pure or applied science. Works intended for consideration in connection with the prize must be sent to the president of the Academy before the end of next year. The contest will close December 31, 1902. The right is reserved to award the prize to an investigator whose work is considered to be the most worthy of the honor, even though he does not submit an account of it.

A NEW BOOK OR COPY HOLDER FOR TYPEWRITERS.

The difficulty of holding books, loose sheets, or documents used by public speakers, copyists, and typewriters is overcome by means of a holder recently patented by Burgess T. Montgomery, of 752 Ninth Street, Washington, S. E., D. C.

The device comprises a rotary pedestal which car-



THE MONTGOMERY COPY-HOLDER.

ries parallel supporting-rods. On these rods the book-holder is slidably mounted. In order to hold the book open (particularly a thick book), two spreaders are employed, one for the bottom, one for the top, of the page. One spreader is mounted on the book-holder, and the other on the parallel supporting-rods above the holder. The essential feature of each spreader is an axial rod passing through a bearing in a line at right angles to the plane of the book-holder, the rod having two bearing-arms offset to the same side of the axial center, so that when rotated about the center the arms will both pass off the book to allow the page to be turned. The axial rod of each spreader is longitudinally adjustable to accommodate books of different thicknesses.

Pivoted leaves or wings at the bottom of the holder form extensions for books of various sizes and thicknesses.

Another feature of the invention which deserves to be mentioned is a line-spacer or indicator pivotally mounted on a side-rod between two friction-clamps.

From the two parallel supporting-rods extending upwardly from the base an arm extends outwardly, which carries an electric incandescent lamp, so that the copy can be illuminated, if it be so desired.

The holder has every motion that can be demanded by the copyist or reader, and is provided with means for receiving all kinds of copy, thick or thin, long or short.

The Current Supplement.

The current Supplement, No. 1314, is commenced by a most interesting article on the maple sugar industry, accompanied by engravings showing the tapping of trees and the boiling of sirup. "Dock Equipment for the Rapid Handling of Coal and Ore on the Great American Lakes" is the continuation of an important article. "Some Links Between Natural History and Medicine" is by J. Arthur Thomson. "Progress of Agriculture in the United States" is by George K. Holmes. "A Model System of Water Works" is by F. O. Jones, and is accompanied by working drawings. The usual trade suggestions from the United States Consuls and Trade Notes and Receipts are published.

Contents.

(Illustrated articles are marked with an asterisk.)