

film. This mechanism, which is but 5 inches in height, 4 inches in length, and 2 inches in width, is mounted upon a metallic plate which can be employed in different apparatus for taking a negative, for looking at the image directly, or for projecting an image in a highly magnified form.

The arrangement for making negatives consists of a box which may be hermetically closed (Fig. 2). Upon one of the sides the objective is fixed at such a height that a sharp image may be formed at the opening, *F*, behind which the film passes. The shutter is placed between the objective and the film. The sensitized film, which is 20 feet in length and  $\frac{3}{4}$  of an inch in width, is placed in a box, *E*. Two slots are provided for the passage of the extremity of the film, which is secured to the actuating mechanism and to the shaft of a pulley carried by a second box, *R*, fixed near the bottom of the apparatus. A small belt connects this pulley with the actuating mechanism and facilitates the winding up of the part that has been exposed. For printing the positives, the same arrangement is used, with the difference that the negative and an unexposed film are brought in contact with each other. If it be desired to examine a positive film without the necessity of making a projection, the mechanism is taken from the photographic apparatus and placed in the microscope. This is a wooden box, upon which is mounted an optical arrangement that brings the line of sight opposite the opening, *F*. The film is wound up at the upper part, and in unwinding causes the images, slightly magnified, to pass under the eyes of the observer.

For projection, the mechanism is arranged in front of the condenser lens of an ordinary lantern, and an objective of wide aperture is placed on the other side in a special mounting. The shutter used in making the negative is removed, and in its stead a shutter having a larger aperture is used. Owing to the wide aperture of this shutter, the image is lighted for a comparatively long time, and with a four-wick kerosene projection lamp of the ordinary type a fairly bright image one meter square is obtained. If an oxyhydrogen or electric light be used, it is possible to obtain large dimensions. In all cases the image obtained is very steady. The Mirograph is essentially an apparatus for the amateur.

#### New Railroad Lines in the Caucasus.

The Committee of Public Works, which is under the direction of the Minister of Transports, has authorized the construction of three new railroad lines in the Caucasus region, of which a description has been recently given in the *Torgovo-Promyshlennaya Gazeta*, one of the Russian official organs. The shores of the Black Sea, an agricultural and mining region, have scarcely any roads, and, on the other hand, but little transportation is carried on by boat, owing doubtless to the poor arrangements of the ports and the violence of the tempests which occur on the Black Sea, which is very deep in these regions. At present a road is in construction, but the Russian government, judging this to be insufficient, has decided upon the construction of a line of railroad uniting the port of Novorossiysk to the Transcaucasian railroad. The line will start from a point between the stations of Dinskaia and Stanitchnaia, on the Vladicaucasus railway, passing by the stations of Bjedoukovsk and Tchernigoff; it will traverse the Caucasus range by the Maikope route and will pass along the coast as far as Soukhoume-Kalé, which at present will be the final station.

The total length of the railroad will be about 28 miles. There is besides a project for a prolongation of the line from the last-named station to that of Novo-Senaki, on the Transcaucasian, a distance of 80 miles. This route will shorten by 450 miles the distance between Tiflis (the capital of the Caucasus district) and Rostoff, on the river Don, the port of the Azof. The line, which is of standard gage, will besides supply the coal mines of Tkvarchelsk, which belong to the government. For this line a company is to be formed with a capital of \$13,000,000. The second project is that of the Kakhetie railroad, which is to have a length of 110 miles and will pass through the wine-growing regions of Tsimondal and Kakhetie. It will start from a point near Tiflis and pass through several towns, ending at the village of Sakobo; it may possibly be continued to the station of Evlakh, on the Transcaucasian. An annual traffic of 190,000 tons is expected.

The total cost of the line, including rolling stock, is estimated at over four millions, which the promoters of the project, Prince Tchavtchavadzé and the engineer, Simberg, expect to realize by an issue of shares. The third project concerns a railroad which will supply the mines of Sadonsk and the metallurgical works of Alaguir, in the northern Caucasus. It will traverse the military regions of the Cossacks of the Terek, inhabited also by the tribe of the Ossetines. Starting from the Vladicaucasus line, the new railroad will pass the gorges of Ardone, through a flat agricultural region formed of a fertile black earth, then crosses the river Argone and passes through an important forest region,

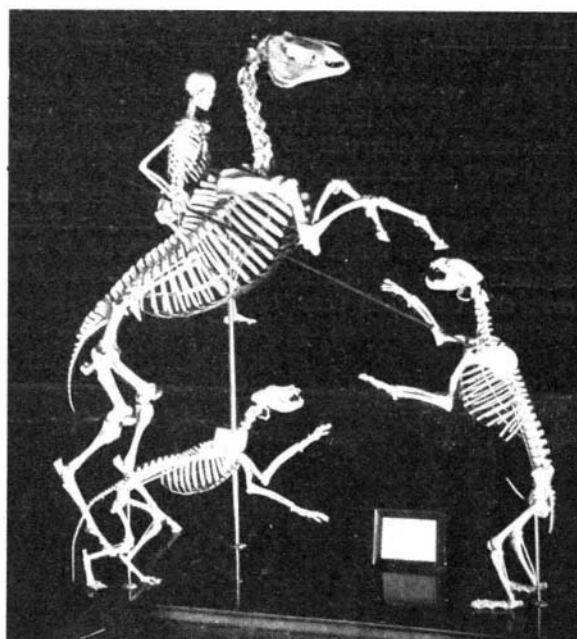
situated at the foot of mountains, which are very rich in argentiferous lead ores, copper, and especially zinc ores. Up to the present, the bad state of the roads did not permit an active working of the Allaguir mines, conceded by the government to a company of the same name. These mines are, however, very rich, and it is estimated that they contain 1,640,000 tons of argentiferous lead and 6,500,000 tons of zinc ores.

#### To Recognize Erased Writing.

In examining hand-writing, Comphuis, army-apothecary at Malang, Dutch East India, succeeded in making erased letters reappear by means of silver nitrate solution. Where an erasure was suspected, a one-tenth normal silver nitrate solution was applied and exposed to direct sunlight for a short time. The letters appeared on the resulting black background. The cause is probably ingredients contained in the ink, which retard the reduction. In the reducing of the silver nitrate solution, impressions of the hands, etc., were also plainly visible.—*Pharmaceutische Centralhalle*.

#### AN INTERESTING GROUP.

This group represents a fight between a mounted Indian and his dog and a grizzly bear. It was arranged by Mr. Charles H. Ward, of Rochester, N. Y., who secured the skeletons and mounted them in positions which the man and animals would assume in a contest at close quarters. The bear reared upon his hindpaws and prepared to strike down the horse with his forepaws, while the dog is in the act of springing upon him. The Indian has charged with his spear,



A SKELETON COMBAT GROUPED BY C. H. WARD.

which is pointed at a vital part of the bear. This is believed to be the first bear hunt in bones ever arranged.

#### One of His Educators.

This is the time of the year when the editor's heart is gladdened by frequent manifestations of what might be termed the personal side of the relations between himself and his readers; who frequently avail themselves of the opportunity offered by the renewal of the year's subscription, to insert a few sentences appreciative of the *SCIENTIFIC AMERICAN*, or a significant statement of the lengthy term of years during which they have been on the subscription list.

Among this year's letters of "renewal" was one from one of our youngest, not our oldest subscribers, in which the writer, who, by securing a new subscriber, had earned our \$2 premium, stated that the *SCIENTIFIC AMERICAN* was a Christmas present to his son, and requested that we comply with the boy's suggestion that copies of the *SUPPLEMENT* be sent to him in lieu of the advertised premium. The letter proceeds: "When our son was nine years old, a copy of the *SCIENTIFIC AMERICAN* found its way to our house, and from that time he never let up on us until we subscribed for it for him. He is but fifteen years old; very fond of reading, and with a mind but for two studies, electricity and chemistry. We live in an isolated farmhouse, too far from schools, and the paper is one of his educators. He is very anxious to take the *SUPPLEMENT*, but we feel as if we cannot afford to give it to him yet." It is needless to say that we were most pleased to accommodate our young Oregon subscriber.

#### The Tiffany Exhibit at the Paris Exposition.

In our issue of October 6, 1900, there was an illustration of the mineral exhibit of precious stones by this company. The fact that there was a still larger exhibit by the same company of the highest type of American jewelry, silverware, etc., in a special pavilion in the Liberal Arts was inadvertently omitted.

#### Electrical Notes.

The first regular meeting of the Roentgen Society of the United States opened December 13, in the Grand Central Palace, New York. About two hundred delegates were present, besides the members from New York.

The authorities in Paris have called the managers of the Underground Railway to account, and they have been fined for permitting the cars to be crowded beyond their seating capacity. The decision stated that American methods would not be allowed to prevail in Paris.

The French Telegraph Department proposes to institute a series of experiments with wireless telegraphy for subterranean communications. The possibility of the scheme was first suggested by one of the inspectors of the department, who found his primitive trials to give satisfaction. The department intends to develop the idea upon a larger scale.

Wireless telegraph stations are to be erected at Inishrahull, in the north of Ireland, and at Kildonan, Arran, Scotland, respectively, for the purpose of reporting and signaling vessels at sea. Colonel Hozier, on behalf of Lloyd's committee, has informed the various Glasgow shipowners of the fact, and expects that the installation will be ready for service by the end of January.

The Adriatic Railway Company, of Italy, has decided to equip electrically two branches of the main line down the coast to Brindisi. These branches extend from the main line toward the interior, where the Apennines furnish abundant water power. In the highlands of Italy there is considerable water power which has never been utilized, and it is considered possible to use these falls for the generation of electrical power.

An electric arc lamp capable of taking a current of only three amperes will shortly be placed on the market. It measures seventeen inches in length, and weighs ten pounds. The carbon is only five-sixteenths of an inch in diameter. Hitherto the arc lamp has been utilized only in connection with great candle power, but the constant desire for a small lamp of this description for certain purposes, in place of the incandescent glow lamp which possesses many inherent defects, has resulted in the designing of this miniature arc lamp.

It is contemplated to construct a railroad, similar to the Jungfrau line, to the summit of Mont Blanc. M. Vallot, the Director of the Mont Blanc Observatory, and M. Deperet, Professor of Mineralogy at the Lyons University, in conjunction with M. Fabre, a French engineer, have been engaged for some time past in surveying the sides of the mountain to ascertain a suitable route and the atmospheric conditions. The result of these investigations is the projection of a line probably starting from the village of Houches, on the Savoy side, to the summit, to have a total length of eleven miles. Twelve stations specially constructed to resist the climatic conditions of the neighborhood will be provided. Electricity, to be obtained from the River Arve and the Mer de Glace, will provide the necessary motive power. The plans of the railroad have been presented to the French Minister of the Interior, and it is anticipated that the official permission will be granted, in which event operations will be commenced immediately.

An attempt is being made by several American capitalists to substitute an elaborate and complete system of electric traction, in place of horses, upon the canals of England. The country is extensively intersected by these water thoroughfares, and in the manufacturing districts, owing to freighting upon them being much cheaper than upon the railroads, they constitute the principal means of transit. Mr. Frank Hawley, the vice-president of the Traction Company, has also been surveying the canals of Holland, Belgium, and France, and has sought powers to introduce electric traction thereon. He has traversed over 3,000 miles of canals in all, and the concessions for this radical change have been granted in Belgium, where it is anticipated that the installation will be completed by next year. The whole of the plant is coming from this country. In England the scheme is only in an embryo stage; but in view of the great success which has attended the introduction of electric traction for other purposes, there appears every probability of the company receiving the necessary permission. The company guarantees an economy of 40 per cent in the cost of motive power. They will also sell power to manufacturers, and supply the neighborhoods through which the canals extend, with a cheap source of electric lighting. It is also explained that another advantage of the system will be that the position of any particular boat will always be known, so that the goods will not be lost sight of by the shipper from one end of the journey to the other. Under the present system of horse traction, owing to the location of the boat not being known, goods are often lost sight of for days.