The Colorado Fuel and Iron Company

MANUFACTURERS OF

PIG IRON, BLOOMS, BILLET
STEEL RAILS—ALL WEIGHTS—ANGLE AND SPLICE BARS, BAR IRON

MILD STEEL, TWISTED BARS FOR REINFORCEMENT, PIPE BANDS, ANGLES AND CHANNELS
Track Spikes and Bolts, Wire Nails, Cement-Coated Nails, Plain and Barb Wire, Bale Ties, Field Fence, Poultry Netting, Cast Iron Pipe and Coke

MINERS OF

Anthracite and Bituminous Coals for Domestic, Steam and Smithing Purposes

GENERAL OFFICES
Boston Building Denver, Colo.
At night a Sea Gulls retreat, In the Day a Hustling Conveyor.

At the farthermost point of Staten Island, the prey of the wintry gale, the target of the summer sun, enwrapped the year round in the dripping night fog—is a Goodrich “LONGLIFE” conveyor Belt. When day comes a contractor pumps sand and gravel from the ocean bed and sluices it down the belt.

Night and day, winter and summer, alternately the hustling conveyor and the perch for ocean gulls—good, old “LONGLIFE” sticks to the job. And for all the assaults of wind and wave this “LONGLIFE” Belt still retains remarkable flexibility and sound body, emphasizing its pronounced ageing qualities and abrasive resistance.

A wonderful Belt is “LONGLIFE.” Before replacing your present conveyor send for a Goodrich Belting Catalogue and read the many fine points on “LONGLIFE.”

SIGNIFICANT: The world's record for belt conveyed tonnage is held by “LONGLIFE.” From 1914 to 1918 in a Utah Copper Mine a “LONGLIFE” Belt carried 7,313,400 tons of ore at a cost of less than twenty cents per thousand tons.

THE B. F. GOODRICH RUBBER COMPANY
Akron, Ohio
Laboratory tests on properly designed apparatus enable you to determine the milling process best adapted to your ore before building the mill—they help you regulate every step of the process for highest efficiency—and the cost is insignificant compared with a mill run. MASSCO Laboratory Milling Equipment saves money and minimizes the possibility of failure in ore treatment—why not equip your laboratory with MASSCO ore testing specialties?

**Wilfley Table No. 13**
A laboratory size Wilfley complete in every detail—enclosed head motion—tilting device—and two interchangeable decks with Wilfley roughing and finishing riffles—a duplicate of our large tables at a low cost that will surprise you.

**The McCool Pulverizer and Sampson Crusher**
Two machines that enable you to quickly prepare the pulp for testing purposes, crushed or ground to any desired degree of fineness—they can be depended upon for long service.

**The Ruth Flotation Machine**
Consisting of an agitation compartment, impeller and spitzkasten, furnishes an ideal outfit for determining the floatable properties of any ore and the effect of various oils and reagents. The pulp thoroughly mixed with air drawn down the hollow impeller shaft is aerated and forced in a steady stream toward the spitzkasten and froth discharge lip—it is a complete laboratory model of the large Ruth Machines.

Write for our Bulletin. Massco Equipment includes every laboratory requirement.

The Mine & Smelter Supply Co.

DENVER, COLORADO

New York Office: 42 Broadway  A Service Station within reach of you.  MANUFACTURERS OF THE MARCHY BALL MILL.

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**Colorado School of Mines Magazine**

Published every month in the year, at Golden, Colo., by the Alumni Association of the Colorado School of Mines.

C. ERB WUENSCHE, '14, EDITOR.

Subscription Price...$1.50 per annum    Single Copies..............25 cents

Officers of the Alumni Association.

<table>
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<tr>
<th>Position</th>
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<td></td>
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<tr>
<td>Vice-President</td>
<td>A. V. Corry, '98</td>
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<td>Secretary</td>
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<td>H. C. Watson, '01</td>
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Vol. X  GOLDEN, COLO., OCTOBER, 1920 No. 10

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**Articles**

- Analysis of Oil Shale
- Observations of the Geophone
- School News
- Athletics

- By C. W. Botkin. The article contains a description of the apparatus and methods used in analyzing oil shale. The author includes many practical suggestions which have been derived from his extensive pioneer work in this new industry. An illustration of the laboratory apparatus is included.

- By Alan Leighton. The article describes the construction of the geophone and its range of usefulness. It can be used in mine rescue work, checking surveys and locating churn drill holes.

- A digest of current technical magazine articles of interest to mining engineers.

- The Alumni Association of the Colorado School of Mines has a capability exchange which renders efficient Employment Service; if you want a man or a new position wire them.
Demonstrate where it pays to advertise.

Modern Motive Might

Mountains, miles and minutes give way before electricity, the magic motive power. Properly applied, it drives giant locomotives across the continental divide, tows ocean liners through the Panama Canal, or propels huge ships. Through good light, safe signals, and illuminated highways, it is making travel better and safer and also increasing the usefulness of transportation methods on land, sea or in the air.

In short, electricity is revolutionizing transportation, making it quicker, safer, more economical and reliable in all sorts of weather.

And back of this development in electric transportation, in generating and transmitting apparatus as well as motive mechanisms, are the co-ordinated scientific, engineering and manufacturing resources of the General Electric Company, working to the end that electricity may better serve mankind.

Introductory.

The amount of oil and ammonia in an oil shale is determined by destructive distillation. Various apparatus and methods vary greatly in different laboratories. Hard glass retorts and distillation flasks have been used, but the charging and cleaning of the glass retort is difficult, and the glass is a poor conductor of heat. Cylindrical retorts made from iron pipe by screwing on caps at the ends are usually free from leaks, but the threads soon burn off, unless used in a horizontal position, and then the retort does not readily permit of even distribution of the retort (iron pipe 6 ft. long, 2 in. in diameter, closed at one end) and method used by B. M. Bailey of the Pumphreton Oil Co., Glasgow, Scotland, for available yield of crude oil is not satisfactory for shales containing lighter-oils, since it is heated with one end open and has no condenser. The United States Geological Survey and many chemical laboratories in the West have successfully used iron "mercury distillation" retorts. I have used these for two years with retorts in shale analysis, and in about fifty-five determinations which I have made on Colorado and Wyoming shales and consider this type of apparatus most satisfactory for both laboratory and field distillations. When this retort is placed vertically and properly heated by one burner a uniform distribution and penetration of heat is secured. The oil is driven to the cooler portions at the center and top and finally out at the top without any chance of overheating, and a maximum of oil is produced which is similar in quality to that produced from the same shale by a plant retort. This retort is easily charged and the spent shale readily removed. "Smooth-On" cement prevents leakages, around the cover of the retort.

The apparatus is set up as shown in the accompanying cut. When available, a flow-meter is used instead of the car boy. A weighed sample (241 grams) of the shale is placed in a one-half pint "mercury" retort and a paste of "Smooth-On" cement (Engineer's No. 1) quickly placed on the junction surfaces of both the retort and cover, and the cover at once clamped down tightly. The retort is placed in position, covered by an insulation (85 percent magnesia steam pipe

General Electric Company

By C. W. Botkin.

Analysis of Oil Shale

The apparatus is set up as shown in the accompanying cut. When available, a flow-meter is used instead of the car boy. A weighed sample (241 grams) of the shale is placed in a one-half pint "mercury" retort and a paste of "Smooth-On" cement (Engineer's No. 1) quickly placed on the junction surfaces of both the retort and cover, and the cover at once clamped down tightly. The retort is placed in position, covered by an insulation (85 percent magnesia steam pipe
The ammonium sulphate contained in the acid solution and the rinse water in the conical flask is determined by one of two methods. The solution may be boiled to a small volume or an aliquot portion measured and the ammonia determined in the usual manner by a Kjeldahl distillation. When the acid solution is not too deeply colored (which is the rule if the shale is distilled slowly) the following method based on the reaction of formaldehyde with ammonium compounds may be used. It is very rapid and almost as accurate as the Kjeldahl method. The solution is boiled to remove carbon dioxide and sufficient litmus solution or cochineal is added to produce a distinct color. Sodium hydroxide is added from a burette until the solution is exactly neutral. When in doubt about the end-point or the end-point has been passed, a few drops of sulphuric acid are added and the end-point again determined. This may be repeated any number of times until the neutrality of the solution is assured. Often dilution with a large volume of water is an aid in making these end-point colors clearer. With litmus it is most accurate to take the end-point where the color begins to change to deep blue. Ten cubic centimeters of neutral 40 percent formaldehyde are added to the neutral solution and the solution boiled for about one minute. The following reaction takes place:

$$6 \text{HCHO} + 2(\text{NH}_4)_2\text{SO}_4 = (\text{CH}_3)_2\text{N}_2 + 2\text{H}_2\text{SO}_4 + 6\text{H}_2\text{O}$$
The solution is cooled to about 60 degrees C, phenolphthalein added, and the sodium hydroxide. One cubic centimeter ammonium sulphate to the ton.

per ton of shale when 241 grams are shale times 8.3 is equal to pounds of ammonia.

grams of spent shale obtained from 241 grams of shale multiplied by 8.3 equals the number of pounds of spent shale per ton.

Analysis by Steam Distillation.

The apparatus and the method are the same as given above with the following changes. The condenser has an iron tube for the introduction of steam, the graduated cylinder is replaced by a liter suction flask, the adapting tube from the condenser extended to the suction flask, a brass or iron condenser tube is preferred, and the small flask for heating the condenser water may be omitted. The shale is weighed until it has reached the steam temperature. Then steam is introduced and continued at such rate as to correspond to the amount used in plant retorting, or so that 200 to 300 cc. of condensed steam accompany the oil. After the oil is all distilled, the steam may be added until it leaves more than 1 percent of the nitrogen in the shale. The heating by means of the Schmatic burner is increased less rapidly than in the distillation without steam.

At the end of the distillation the acid solution in the Meyer tube is poured into the suction flask. If the solution is alkaline, some more water is added until it is acid.

The oil and water are then separated in the separatory funnel, the oil is measured in the graduated cylinder and the ammonium sulphate is determined by one of the methods already mentioned.

The following are the results obtained by six different distillations of a sample of Colorado shale, and the ammonia content and in the water is determined by one of the methods already mentioned.

The geophone is an instrument invented by the French during the war to detect, through the earth, the tapping of underground cavities or mines, and its use in connection with special sounds has been developed.

The instrument, though small, is essentially used for each ear, since it works on the same principle as the ponderous apparatus by which earthquake tremors are recorded. It consists of an iron ring about one-half inch in diameter, within which the air is expanded a lead weight that is fastened by a single bolt through two metal discs (pure nickel discs 0.025 in. thick are used) one of which covers the other the bottom of the ring. There are two brass caps, the top one having an opening in the center to which is fastened the stethoscopic ear-piece. These cap pieces are fastened with bolts to the iron ring and serve also to hold the metal discs in place.

We then have really nothing but a lead weight suspended between two thin discs that extend across a small air-tight box. If the instrument is placed on the ground and anyone is pounding or digging in the vicinity, energy is transmitted in wave motion through the earth, and the earth waves shake the stethoscope ear-piece. The lead weight, on account of its mass, and because it is suspended between the discs, remains comparatively motionless. There is thus produced a relative motion between the instrument case and the lead weight. The result is that in the thin space over the disc, a compression and rarefaction of the air alternately takes place which is magnified at the small outlet. Since the rubber tube leading to the stethoscopic ear-piece is connected with the spout of the geophone, the vibrations are transmitted to the ear drum and like other rapid air waves produce sound effects. Usually two instruments are used, one for each ear.

When two instruments are used, it has been found that the sound is apparently louder from the instrument nearer the source.

The geophone is placed on the ground and the observer moves away from the instrument. Further observation will show which direction is the sound is coming from.

The Bureau of Mines has conducted an investigation to determine the conditions of operation under which the geophone will give the most satisfactory results when used for rescue and survey work in both metal and coal mines.

In coal mines it has been determined that the geophones should rest on a solid shelf of coal or on the floor of a niche cut into the coal. The floor of the mine is likely to be covered with dirt, and is very seldom solid enough to transmit sound well. In metal mines the geophones will, of course, be held against the natural rocks. If the geophones are held against the coal, vibrations are set up by the circulation of the blood within the viscera that greatly interfere with successful observations. On the other hand the rock appears to withstand these vibrations, and successful results can be obtained by simply holding the instruments in place on the rock.

If a man is pounding in the hope that he may be located by means of geophone he should strike a heavy blow upon the coal or rock. The best results are obtained with a sledge, or a heavy stick of timber. This is true even if the man expects to be located by means of beam and underground mining operations of the United States Engineers, and more recently developed by the Bureau of Mines, and its use in connection with special sounds has been developed.

Sample No. 1

Water, gallons per ton 1.65
Oil, gallons per ton 2.5
Gas, cubic feet per ton 4383
Ammonium Sulphate, pounds per ton 602
Spent Shale, pounds per ton 1130
Gravity of Oil, Be 11.8
Satisfaction of Oil, percent 21.1

Sample No. 4

Water, gallons per ton 73.1
Oil, gallons per ton 82.5
Gas, cubic feet per ton 3807
Ammonium Sulphate, pounds per ton 21.9
Spent Shale, pounds per ton 1065
Gravity of Oil, Be 12.2
Satisfaction of Oil, percent 13.2

PRODUCTION OF ASPHALT IN THE UNITED STATES.

A preliminary estimate of the production and sales of asphalt and native bitumens and allied substances in the United States in 1919, has just been made public by the United States Geological Survey Department of the Interior. The asphalt produced from domestic petroleum amounted to 600,000 tons, and from natural bitumens and allied substances valued at $3,245,796, respectively. The asphalt produced from Mexican petroleum amounted to 627,000 short tons, valued at $7,001,000, an increase from 1918 of 228,000 tons, and an increase in value of $2,970,920 in value. About 115,000 short tons of bituminous and allied substances were produced in 1919, an apparent increase over 1918 of 54,365 tons and of $213,102.
pended; on the other hand, if they are buried in loose dirt for a distance as short as fifteen feet the sound vibrations may be completely damped. For this reason a man should never pound on a pipe line or the rails unless he is certain that they are entirely free from any covering. Since the sound does not travel well through the rock or coal, pounding on pipes would seldom be advisable.

In making observations from the surface a mine, the geophone must be pressed upon the earth. In two instances experiments were conducted with the geophones placed upon stakes driven into the earth, but this method was found not to possess any advantage.

In regard to the distances that sounds can be detected through the earth, Edge said that softer rocks are more easily penetrated; on the other hand, if they are entirely free from any covering. The sounds of the drill operating in the drift showed that the raise extended to a point six feet above the drift, and that the sound was not reduced to a point below that surface. A similar sound could be heard was found to be the nearest point to the surface area. Later observations made around the base of the coal showed a lower rate of interest because the same kind of sound was audible here. At the second fire, which was burning three hundred feet below the surface, the sounds from dropping rock could be heard.

It is the custom in some localities to put down churn-drill holes from the surface to waste blind stops and to carry pipe lines. These holes often come down in the solid, and much expense is incurred in locating them and driving tunnel lines to the surface. The geophone will be of great value here, and therefore his determination of faintness of sound since churn-drilling can be detected nearly a mile away.

The primary obligation of the American Red Cross is to the Service Man of the Army and Navy. Five duties still remain:

First—To stay with the Army of Occupation, comprising about 17,000 officers and men.

Second—To continue in the hospitals of the Army, the Navy and the Public Health Service where there are more than 26,000 men, many of whom will be there for months and years, and carry on recreational and social work.

Third—To keep in touch as an Advisory Organization with the discharged men of the Army and Navy, and be ready—not in the way of financial aid—but what is worth more, to contribute kind advice and friendly assistance.

Fourth—To carry on the work with the families of the discharged men, officers and sailors and for the community at large.

Fifth—To care for those blinded in the crash of a war, a Service turned over to the Red Cross by the government.

"Am I my Brother's keeper"? is the stammering of a sort of selfishness. Answer the call of your Red Cross, which holds its Fourth Roll Call November 11, and fulfill your obligation to the brother who has served us.
The potash industry in Nebraska has been suffering for lack of proper support from the fertilizer companies. During the war, when the importation of potash from foreign sources was cut off, the companies mixing fertilizer were dependent upon the home product of potash and were willing to pay high prices for the same. During that time the potash companies prospered. With the signing of the armistice, the fertilizer companies were content to sit back and wait for the lowering of prices on potash as a result of renewed importations. These importations have failed to meet the needs and the domestic product again has a market, though at much lower prices than formerly, with more willingness on the part of the consumer of potash for fertilizer, to patronize home production, which will come a larger and steadier supply for his needs.


Two necessary features of a mine signal system are safety, reliability, speed of operation, low maintenance cost, and simplicity. The most important consideration of safety recommends the use of electric systems.

The Copper Ore of Lake Superior. By J. E. Spurr. (E. & M. J., August 21, 1920.)

The copper-bearing formation is a thin series of conglomerates and basic surface lavas. Mineralization occurred in the conglomerate by replacement and impregnation. The greater part of the copper is likely to be inter-crystallized with chalcoite, which shows the scarcity of sulphur in the solutions. J. A. H.


The question about the value of sulphur in calculating a furnace charge and production for one year are a puzzle, according to the three different effects of sulphur, in causing the variation in value. Fuel value, reducing value, and smelting value, are the points considered. For the first two it is found that with the addition of from 1 percent to 10 percent of sulphur a good black copper charge will smelt with a decrease of from 17 percent to 8 percent of coke. From that point the value of sulphur declines until it becomes an expense. The matting value, from a standard standpoint, is indeterminate. R. W. P.
FINANCIAL REPORT OF THE COLORADO SCHOOL OF MINES ALUMNI ASSOCIATION, BY THE ASSISTANT SECRETARY-TREASURER.

From June 2, 1919, to May 8, 1920.

NOTE: The fiscal year closed on May 8th because the new officers of the Association were elected on that date at the annual banquet.

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<td>2,128.37</td>
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Total Balance $708.22

| Credit Magazine | 50.24 |
| Special Account | 107.74 |
| Cash Balance    | 708.22 |

\[This amount includes $1,097.30 received from subscriptions and $2,128.37 from advertisements.\]

\[This loss is due to having Aller's Notes on Rapid Methods of Technical Analysis and Trappagen's Notes on Assaying printed.\]

$1,097.74 profit operation magazine

646.12 profit operation capability exchange.

$1,737.86

Less salary $1,275.00

Balance $462.86 Credit magazine account for year 1920-1921, revenue from subscriptions.

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<td>$588.46</td>
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Cash on hand $708.22

SUMMARY.

Liabilities.

| Titwosworth Fund | $300.00 |
| Credit Account   | 97.86   |
| Magazine Subscriptions | 462.86 |
| Special Fund     | 50.24   |
| Alumni Association Balance | $37.26 |

Total $1,248.22

Assets.

| Liberty Bond | $508.00 |
| Notes Outstanding, Titwosorth | 40.00 |
| E. T. Hager, of San Luis Obispo, Calif., has moved to 807 Baker-Detweiler, Los Angeles, Calif. |

Mr. and Mrs. Charles L. Harrington, of 3559 Franklin Street, Denver, Colo., announce the birth of a daughter, Virginia Lee, on October 6th.

Mr. and Mrs. Albert L. Tooneoa announce the arrival of Benjamin Harry on September 21st at Pittsburgh, Kansas.

Donald Dynernorth, formerly general superintendent Akron Mines, Whitepine, Colo., is now with the Dorr Co., Denver, Colo.

Harvey Matthews has gone to Red River, New Mexico, on an extensive mine examination trip.

Philip E. Noland's address is care Carlos del Minerales y Metas, S. A., Monterrey, N. L., Mexico.

Lionel Brooke is superintendent of the Eagle Holly Mining Co. and the Bullwhacker Cons. Mines Co. of Bureka, Nevada.

Mr. Strong's address is 1213 Halford Bldg., San Francisco, Calif. He is metallurgist for the Metals Exploration Co.

We have just learned the sad news that Ralph W. Smith lost his wife on October 12th at Scottsbluff, Nebraska. Mrs. Smith was only ill one week. She leaves her two-and-one-half-year-old daughter, Barbara Jane.

E. V. Graybeal is located at Miami, Ariz.

Mrs. Van Burgh are rejoicing over the recent arrival of a baby boy.

Miss Hazel Blake of Chattanooga, Tennessee has been acting as secretary-treasurer of the Colorado School of Mines Alumni Association.

Lisel Reineke has resigned his position at the Butte & Superior Mining Co. He is now with the Champion Mining Co., race track, Montana.

R. Van Burgh has been transferred from Minnet, Mont., to Denver office of the Frantz Corporation, 330 First National Bank Bldg., Denver, Colo. Mr. and Mrs. Van Burgh are rejoicing over the recent arrival of a baby boy.

Robert A. Thurston is at the Kirk Mine of the 4-C Co. at Cannas, Sonora, Mexico.

Roger F. White and Miss Esther L. Plimpton, of Modesto, Calif., were married in Washington, D. C. on September 30th. They will reside at 3012 McKinley Street, Chevy Chase, D. C.
EX-MINES NOTES.

Mr. and Mrs. Chas. M. Beyrle announce the recent arrival of Beverly Ann, at Christmas, Ariz.

OBITUARY.

Thos. P. Ellis died at Alameda, Calif., on September 27th. He had been ill for a month. The end came very unexpectedly, as he was convalescing when pneumonia set in. He leaves a wife and three children. Mrs. Ellis will reside at R. F. D. 3, Box 125G, San Diego, Calif.

SCHOOL NEWS.

Harold Crooks, Associate Professor of Geology, resigned his position on November 1st to accept a position on the geological staff of the Standard Oil Co. for service in Venezuela, South America. He will be succeeded by James J. Lillie of Frisco, Utah, a mining geologist and graduate of the University of Utah. Prof. A. B. Bellis, recently organized a brass band amongst the School of Mines students. About twenty-five men have reported for rehearsals. The new organization promises of being an excellent one.

Major G. C. Dobson, who has been commander of the School of Mines reserve training corps, since it was organized, is leaving the army. His place here will be taken by Captain R. S. Irwin. Major Dobson will go back to civilian life to follow his old profession as a civil engineer. Captain Irwin is a graduate of West Point. During the war he served overseas with the second regiment of engineers, second division. He was badly wounded in the Chateau Thierry engagement.

Electrical Testing Facilities at the School.

The Department of Electrical Engineering of the Colorado School of Mines, in conjunction with other departments of the school, has equipped a laboratory for the making of tests of electrical apparatus and equipment for use in mines and mills.

1. Wires and cables; dimensions of conductor and insulator; specific resistance of conductor material; dielectric strength of insulation; continuity of insulation; effect of temperature, moisture, oils, chemicals or gases on the insulation.

2. Insulation: specific resistance and dielectric strength; effect of temperature, moisture, oils, chemicals, or gases on the insulating qualities of the samples.

3. Line insulators: insulation resistance; wet and dry flash-over voltages.

4. Transformers: watt and current capacities at various rates of discharge; voltage characteristics; regulation, local action, recuperation.

5. Primary batteries: watt and current capacities at various rates of discharge; voltage characteristics; regulation, local action, recuperation.

6. Dry cells: tests in accordance with the American Electro-chemical Society specifications for telephone service, igniton service, and intermittent lighting service.

7. Storage batteries: efficiencies at various rates of charge and discharge; weight, voltage per ampere-hour and watt-hour; voltage curves on charge and discharge; ampere-hour and watt-hour capacity; loss of charge due to standing; time of service; recuperation after high discharge rates; internal resistance; effect of temperature on capacity and efficiency.

8. Circuit closing devices: durability; heating; current capacity; safety when operated in an atmosphere of explosive gas; effect of moisture.

9. Safety switches; current capacity; reliability when used in an atmosphere of explosive gas; effect of moisture.

10. Generators and motors; efficiency; regulation; resistances; rating; temperature rise; effect of moisture on insulation resistance.

Equipment.

The following equipment is available in the various departments of the School:

Potentiometers for accurate determination of current and voltage.

Standard cells.

Standard resistances.

Standards of inductance and capacity.

A wide range of voltmeters, ammeters, and wattmeters of commercial accuracy.

100 kva, 2300 volt 60 cycle 3-phase alternator.

75 kw, 230 volt 3-wire direct current generator.

75 kw, 120 volt twin unit direct current generator.

80 kva, 1100 volt 125 cycle single phase alternator.

5 volt, 60 ampere continuous current generator for the electrodeposition of metals.

Transformers up to 25000 volts.

Several serviceable, compound and a.c. motors and generators of capacities 15 kw. and under.

Electrical Testing Arrangements.

Two different proposals for the use of the equipment are offered:

A. Any responsible person or organization may, with the consent of the President of the Colorado School of Mines, use the equipment by paying for the actual material, labor, power, water, expenses, assistance used, and depreciation. In this case the plant will be responsible for the accuracy of the results obtained.

B. The professor of electrical engineering will run the test, in which case the charge will be equal to the cost of similar work done by him in his laboratory, or by a consulting engineer, will be made. If desired, an estimate will be made of the cost of the tests to the person making the test, but this will not be used in billing for the tests. The department of electrical engineering will be responsible for the accuracy of the results, and will make a report to the person authorizing the test.

Material and apparatus may be shipped by express or freight directly to Golden, Colorado, all charges prepaid. Freight sent via the Colorado & Southern Railway or via the Denver & Interurban Railway yards to the electrical engineering laboratory at the expense of the shipper.

All details as to the responsibility of the testing equipment, the mode of making payment, handling of the shipments, nature of the test work to be carried out, the persons to whom reports are to be made, etc., must be clearly understood as a result of correspondence or a conference before consignments of apparatus or material will be shipped.

ARLINGTON P. LITTLE.

Professor of Electrical Engineering.

The following methods are available:

1. Wire and cable test; dimensions of conductor and insulation; specific resistance of conductor material; dielectric strength of insulation; continuity of insulation.

2. Insulation test; specific resistance and dielectric strength; effect of temperature, moisture, oils, chemicals, or gases on the insulating qualities of the samples.

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8. Circuit closing devices test; durability; heating; current capacity; safety when operated in an atmosphere of explosive gas; effect of moisture.

9. Safety switches test; current capacity; reliability when used in an atmosphere of explosive gas; effect of moisture.

10. Generators and motors test; efficiency; regulation; resistances; rating; temperature rise; effect of moisture on insulation resistance.

METER SYSTEM EXPLAINED IN ONE MINUTE.

A member of World Trade Club held the world record for rapid explanation of the Metric weight measurements and the way in which they are used. He does this in one minute. An objector who had never looked the matter up declared that the whole system was complex and that it would take nearest three hours to learn it.

It was then that the member of World Trade Club first undertook to explain, in one minute, all that had to be known of the metric system. He used 10 men in the satisfaction of Mr. Ellis.

"ACCIDENTS WILL HAPPEN."

The American Red Cross relief train was recently somewhat impeded while passing through the Balkan states where the switches were not the same as the ones in this country, which appeared to be wandering aimlessly about near the railroad track. After being awakened several times during one night check, the train, after starting out on a tour of investigation, bent upon discovering if all the cows in Roumania were sleeping on the track. Upon emerging from the train he found the carcass of a young bull lying by the track with tether ropes attached to his fore and hind legs and a peasant and the Thursday night preparing to skin him.

The Red Cross interpreter and Red Cross bed and Red Cross secretaries demanded an explanation of the strange proceedings. He learned that the Romanian government had passed an edict forbidding the slaughter of live stock for one year. Since there was nothing in the usages regarding accidental slaughter, these "accidents" were common occurrences in the country.

THE PUBLIC HEALTH CRUSADE.

Acting on the principle that a large portion of the diseases of the world is preventable, a nation-wide movement is about to be inaugurated in the United States for the promotion of public health. Information will be given to committees by lectures given by Red Cross nurses on Chautauqua circuits, which will be followed up in the smaller communities by nursing States for the promotion of public health.

Information will be spread by lectures in schools, as well as to committees which have already been established. Every assistance will be given to communities in organizing and maintaining this service.
ATHLETICS

By Ralph C. Maxwell.

Mines 3; Utah Aggies 27.

On October 26th, the teams played the Utah Aggies at Logan, Utah, and although they were beaten by a score of 27 to 3, the trouncing was not as bad as the score would seem to indicate. The mines were outplayed and outscored in the earlier Utah game, but in this contest the score stood at 20 to 0 in favor of the Aggies. The head linesman was evidently influenced by the presence of many Utah rooters, he reversed his decision declaring the Mines' fumble on the recovery of a blocked punt. The game ended with the Aggies ahead 20-0.

Mines 0; Colorado Aggies 27.

Colorado Aggies defeated Mines 27 to 0 in a clean and well-played game before about 5,000 spectators. In the first period the Farmers had everything their own way, going through the Mines' line and around their ends at will. Before the first half ended, the Colorado Aggies had made three touchdowns, all in the first quarter. D. Hartsorn made all of them, scoring on the outside of the Mines' line and running for a touchdown. The head linesman was evidently influenced by the presence of many Utah rooters, he reversed his decision declaring the Mines' fumble on the recovery of a blocked punt. The game ended with the Aggies ahead 20-0 in favor of the Aggies.

The line-up follows:

Mines: Lindenmuth . . Bresnahan

Gibbons . . . Nichols

Clough . . . E. G.

Bain . . . Meyers

Houssels . . . McMichael

McGlone . . . T. L.

Mitchell . . . E. E.

Poulin . . . Q. B.

Donaldson

Clark . . . H. D.

Hartsorn

Fahey . . . F. H.

Haskins . . . L. F.

Scott

Mines 7; Wyoming 14.

It seems as though the Jinx has been following the Mines all season long. Their first touchdown of the season came when they played Wyoming on October 30th, but although the team played better football than the Wyoming contingent, their first touchdown was a result of a well-timed tackle. The Mines' first touchdown was the result of a forward pass which brought the ball to the two-yard line, where it was pushed over by two players. The Mines' first touchdown came when the Mines were the direct result of two passes, Poulin to Jordan. Wyoming's second score was made by Herman, who caught the ball on a punt and ran through the whole Mines team for a touchdown. Both of the Wyoming scores were the result of great efforts of the Mines team.

The line-up follows:

MINES: WYOMING

Mitchell . . . E. E.

Hedges

McGlone . . . T. L.

Neff

Black . . . C.

Long

Gibbons . . . R. G.

Liers

Crawford . . . R. T.

Buchanan

Poole

Bollin . . . Q. B.

Wilson

Robertson . . . L. H.

Simpson

Bunce . . . F. B.

Fitzke

Jones

Official: Crowley, referee; Buscham, umpire; Shafer, Head Linesman.

The line-up follows:

MINES: AGGIES

Lindemuth . . . Bresnahan

Gibbons . . . Nichols

Clough . . . E. G.

Bain . . . Meyers

Houssels . . . McMichael

McGlone . . . T. L.

Mitchell . . . E. E.

Poulin . . . Q. B.

Donaldson

Clark . . . H. D.

Hartsorn

Fahey . . . F. H.

Haskins . . . L. F.

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AGE OF WATER POWER DEVELOP- MENT NEAR.

Many Developments Already Completed—The Power of Water Analyzed.

These who look into the future with prophetic eyes predict that an age of water power is dawning. They point wisely towards the great water power developments already completed or in course of construction all over the world, from the rivers of Maine to the canyons of California; from Alaska to the outlet of Victoria Nyanza in Africa. And back up their arguments with the statement that the great water power developments will be completed early in the next century and that mineral oil and natural gas will vanish with them.

And all this prognosticating and arguing arises from a host of questions about this water power which is to keep us from freezing in the next century, to turn the wheels of our industries, to prepare the food and to run our vehicles.

The power of water is greater than any one without experience can imagine. For many of us, when we are swimming, we are swimming on a river of water. Most of us have lived in houses near a stream of water, and we know that water is a source of power. Water power represents heat energy. The power is water's ability to do work. It is the total mechanical effect of the water, resulting from its speed, pressure, and temperature. Water power is the energy of flowing water.

The power of water is greater than any one without experience can imagine. For many of us, when we are swimming, we are swimming on a river of water. Most of us have lived in houses near a stream of water, and we know that water is a source of power.
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