REINFORCED CONCRETE ON THE PACIFIC COAST.

BY H. A. CRAFTS.

While reinforced concrete as a structural material has attained wide popularity in Europe and the eastern part of the United States, its general use on the Pacific Coast may be said to be almost in its infancy.

Round about Los Angeles it has entered into building operations to a considerable extent, but north of that point, even to the British line, its use has hitherto been very limited.

The steel and brick influences of San Francisco have been sufficiently powerful to exclude it from that city and neighborhood. In fact, San Francisco has an ordinance prohibiting its use within the corporate city limits.

But the ice seems about to be broken, and this will come about through the influence of a single San Francisco firm—the Pacific Construction Company.

Early in 1905 the Willamette Pulp and Paper Company, of Oregon City, Oregon, presented plans to the Pacific Construction Company for a very large paper mill building to be erected in the city named.

The plans called for a brick and steel building, but by advice of F. A. Koetitz, chief engineer and vice-president, and F. M. Butler, secretary of the Pacific Construction Company, the plans were changed so as to call for reinforced concrete in place of brick.

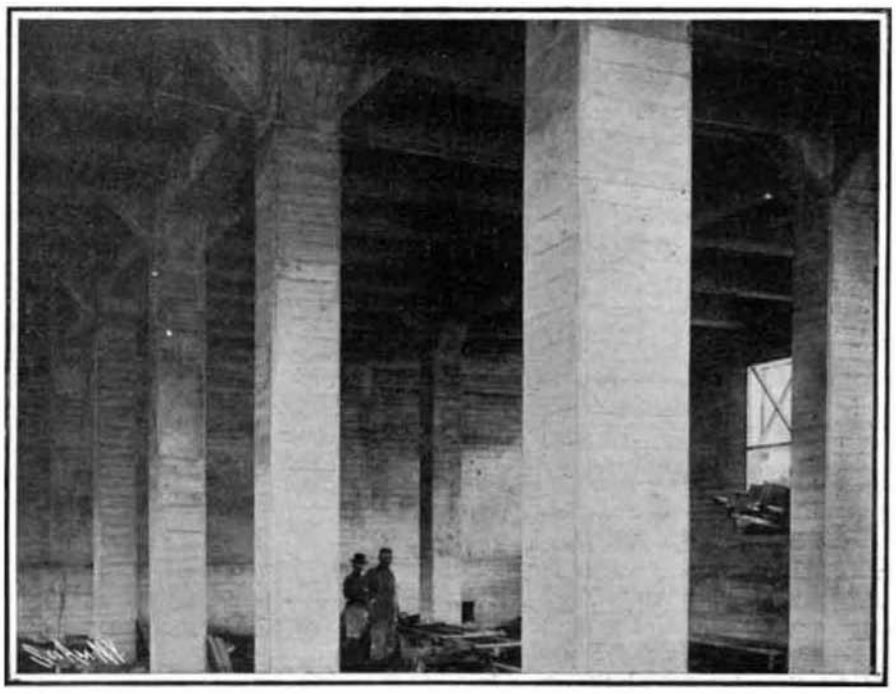
The advice upon which this change was based was given for several reasons. In the first place, the Willamette Pulp and Paper Company were in haste to have their building built, and it was shown that much time could be saved by using reinforced concrete in place of brick.

Another principal reason was the conditions that would naturally surround a building erected in this special location, and devoted to the special purpose of pulp and paper manufacturing. The climate of Oregon City is a very rainy one, and the making of pulp and paper at the same time necessitates the use of a great deal of water; consequently, a building so located and so employed would be subjected to much moisture, both from without and within.

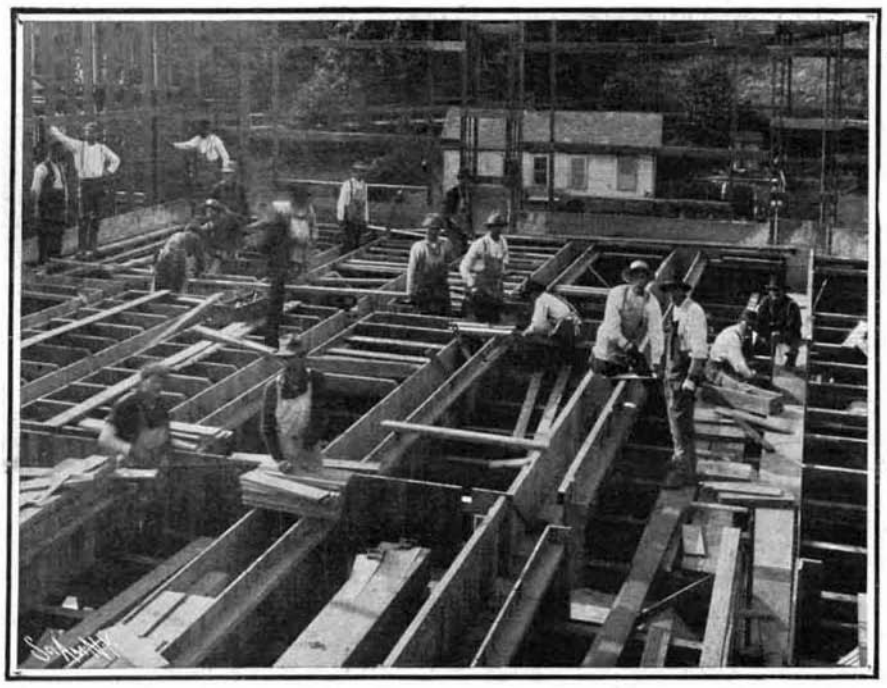
The paper mill building at Oregon City has just been completed, and is one of the largest of the kind on the Pacific slope. It is 339 feet long, 92 feet wide, and its walls are 56 feet high. It has a basement and two floors at the "beater" room end, and a basement and single floor in the machine room end, with 20 feet between floors.

The foundation was laid upon a bed of heavy bowlders from the river. Trenches for the foundation walls were dug in the bowlders, and footings five feet wide put in.

On top of these walls, and reaching up to the sills of the basement windows, the walls of the superstructure were made 28 inches thick; while the main walls of the building were made 12 inches thick, buttressed by 3-foot pilasters, 16 feet on centers, the pilasters being 20 inches thick. These pilasters are reinforced by corrugated steel bars, six bars being imbedded in each pilaster, and held in place by bands of 5/16 round iron, one foot apart. Through the main walls, both above and beneath the window openings, and extending the entire length of the walls, corrugated steel bars were also used.



Interior, Showing Finished Concrete and Steel Columns and Floorbeams.



Constructing the Wooden Forms for the Floorbeams.

Supporting the floors are concrete columns 20 x 24 inches in size and 16 feet apart lengthwise of the building, and at varying distances crosswise of the building, the distances being regulated to accommodate the machinery, and there being four lines of columns.

The main girders running lengthwise of the building are 20 x 36 inches, and the cross beams connecting thereto are 14 x 26 inches. The columns are reinforced by corrugated steel bars, four in each column, connected and held in place by 5/16 round iron. The beams are reinforced by both Kahn and corrugated bars. The floors comprise concrete slabs of an average thickness of six inches, which are reinforced by expanded metal. The top is finished with the usual sidewalk finish. In the basement story are also placed numerous piers for carrying the weight of the line shafts and paper mill machinery, all being reinforced by the same material as used in the beams.

The materials used in the manufacture of the concrete consisted of local Willamette River gravel and Columbia River sand mixed with Teutonia cement.

The form sheathing was beveled 1 x 6 surfaced boards.

The roof trusses are steel girders spanning the whole 92 feet width of the building, and the roof covering is of wood felt with graveled top.

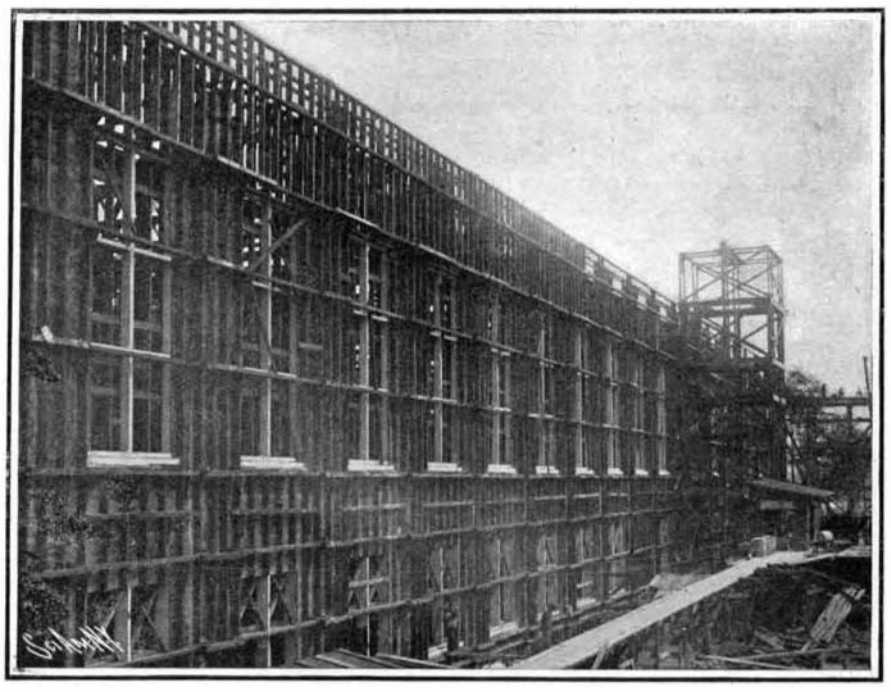
The materials entering into the manufacture of the concrete were landed upon the bank of the river near the site of the building, loaded into cars with an electric derrick, and the cars were then run to the mixer hopper.

After passing through the mixer the material was delivered into wheelbarrows, and the loaded wheelbarrows were raised to the required height by electric elevators.

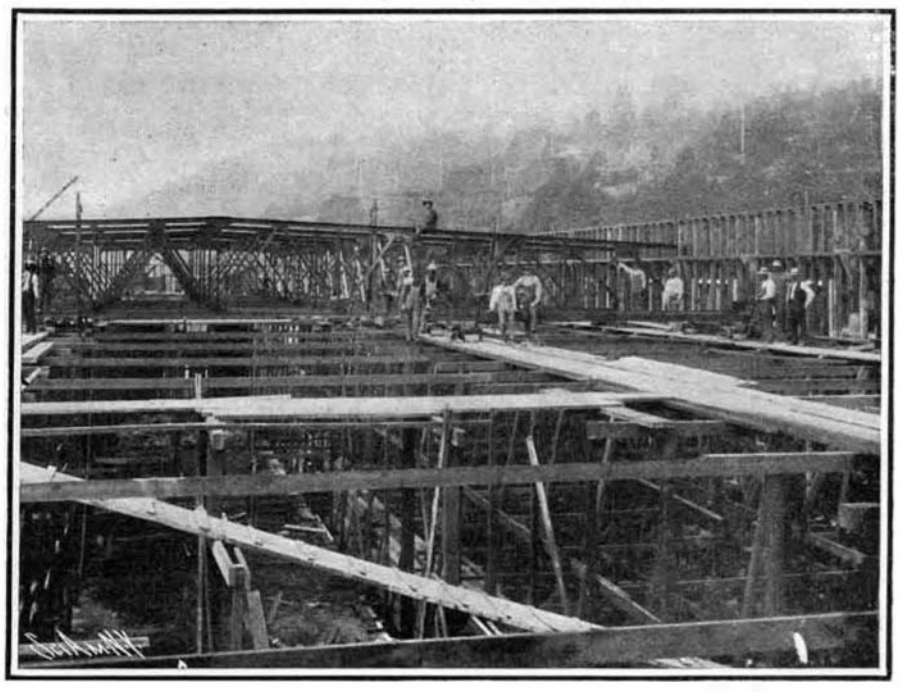
The building was completed within a period of six months, and cost the paper company in the neighborhood of $100,000.

Some New Facts About Animals' Eyes.

For some years past the eminent British ophthalmologist, Dr. Lindsay Johnson, has been investigating the eyes of animals, and has made some valuable discoveries of great interest to zoology and our knowledge of the evolution of various animals. One of the most remarkable of these researches is a confirmation of Darwin's theory that man is closely related to the primates. From his investigations Dr. Johnson has found that the eyes of all the apes, including man, are practically identical. Each has the highly complex system of veins and arteries, and the direct or parallel vision. According to this authority, the dog has two ancestors, one round-eyed and the other oval-eyed. The first is the hyena, and the latter the bear through the raccoon. All animals exposed to chase by enemies, such as the hare, rabbit, and squirrel, can see all around, and all the rodentia squint. The lower an animal in the scale, the further is its eye from parallel vision. According to this authority also, the corpus niger, or black body of pigment, in the eye of the horse, which has proved such a source of speculation to the naturalist, veterinarians, and zoologists, reveals through the ophthalmoscope a new means of tracing the ancestry and relationship of the horse. The eye curtain is precisely the same as that which is found in all tropical animals, such as the onega, camel, antelope, etc., and fulfills one important function—the protection of the



View Showing the Wooden Form for Erection of Side Walls.



Raising the Roof Trusses.

CONSTRUCTION OF A CONCRETE AND STEEL BUILDING AT OREGON CITY, OREGON.

eye from sunlight. One result of Dr. Johnson's researches, according to Prof. Ray Lankester, the celebrated zoologist, will necessitate a reclassification in one section of zoology.

A GRAVITY CABLE RAILROAD IN THE SWISS ALPS.

One of the most remarkable railroads, that constitute such a feature of railroad communication and construction in the Swiss Alps, is that connecting Lauterbrunnen with Mürren. The former township, which is in the valley, is the terminus of the Bernese Oberland railroad, connecting Lauterbrunnen with Interlaken, and forming part of the Bern-Mürren trunk line. Mürren, however, is a small Swiss village situated in the Bernese Oberland, 5,385 feet above sea level, on the opposite side of the valley which is crowned by the Jungfrau. The mountain side is particularly steep, and the railroad stretches from Lauterbrunnen to the Grütsch Alp, 4,890 feet above sea level. Its terminus constitutes one of the most remarkable engineering feats in Swiss railroad engineering.

The track has a striking resemblance to a ladder, so sharp is the angle of the gradient. The mountain face is very rugged, abounding with small, sharp ravines, through which the mountain torrents rush toward the lower-lying country and river, which extends through the valley. The consequence is that in order to negotiate these undulations in the ground, it was necessary to erect viaducts, so as to insure a uniform gradient. These viaducts, of which there are several, are constructed of rough masonry on the small-arch principle with thick, stout piers carried to a substantial depth, to obtain sufficient rigidity to withstand the pressure of the torrent waters in the rainy season.

At other places the track extends through cuttings, and the ballast removed from these sections was employed for strengthening the embankment at points not too well served in this respect. Upon the inclined plane thus constructed the railroad is laid. The rails are carried upon transversely-laid sleepers. There is only one track; but as the railroad is operated upon the simple though highly efficacious principle of raising a pendant weight by the connection of a heavier one upon the other end of the attachment, there is a half-way station, where the ascending and descending cars pass, and at this point the track resolves itself into two loops.

The total length of the railroad from Lauterbrunnen to the Grütsch Alp is 4,530 feet, and the average gradient is 55 in 100, with a maximum of 60 in 100. Down the center of the track is laid a rack rail, in which runs a cog wheel carried underneath the car, which not only greatly assists the car in climbing, but in the descent acts as a highly efficient restraint over the force of gravity.

The railroad is operated by cable, the ascending car being connected by a wire rope, which passes over a drum in the power house at the summit, and thence to the descending car. The cables furthermore are water-balanced. Large pulleys are placed at frequent intervals to carry the cable.

The cars are self-contained, and start from the opposite ends of the road simultaneously, telegraphic communication being maintained between the two termini for purposes of signaling. Each car carries a water-ballast tank, but only the descending tank car carries the water-ballast charge, in order to impart the necessary momentum to overcome the inertia of the car stationary at the lower station. As the car descends, water is gradually emptied from the tank. The displacement of the water coincides with the weight of the cable, which lengthens as the ascending car approaches the top. The skillful manipulation of this water ballast constitutes one of the most important factors in the safe operation of the railroad. Each car must travel at the same speed, and progress must be steadily maintained, so as to obviate any sudden jerks, which would throw severe strains upon the cable. Upon each car is attached a time indicator, and the rate of progress is regulated by the authorities. In order to guard against any inadvertent acceleration in the velocity, a powerful automatic brake is supplied to each car. Should the speed exceed that which is prescribed, the brakes come into operation, and thus check the engineer's progress. As a further precaution against careless or reckless driving, the engineer is subjected to a scale of fines, which are rigorously enforced by the authorities, information concerning this point being supplied by the time indicator.

To guard against any disaster resulting in the remote possibility of the cable rupturing, and to prevent the car running away and getting beyond control, each vehicle is equipped with two powerful brakes in addition to the automatic brake, and these, in conjunction with the cog wheel placed beneath the car, are sufficient to hold it stationary upon any part of the gradient. Accident is thereby adequately provided against, and it is this careful braking system which is responsible for that element of safety so characteristic of these mountain railroads in Switzerland. The cars pass each other at the half-way point by means of a turn-out provided for the purpose; and at this point a momentary stop is made.

The cable has a breaking strength of 62 tons, and it is a splendid testimony to the care used in making it, that the same rope is in use to-day as when the railroad was first opened. The cable is thoroughly inspected at frequent intervals, and not even the weakening of a single strand has been discovered. The cars travel at the rate of 226.35 feet per minute, the whole journey occupying 20 minutes. This rate of progress is much greater than that attained by the locomotive-operated mountain railroads, such as the Rigi, where the speed is only 186.35 feet per minute, and the maximum gradient in three miles is 48 in 100. There is one other important cable-operated railroad in the Swiss Alps, that at St. Beatenberg. This railroad, which also has a maximum gradient of 60 in 100, is 12,795 feet in length and occupies 50 minutes to negotiate. Though the Mürren railroad is of practically the same gradient throughout, the St. Beatenberg track at one section has a rise of only 34 feet in 100, to cover which occupies 15 minutes.

From the Grütsch Alp station extends an electric railroad of the conventional overhead trolley type to Mürren. During the whole of the journey to the latter terminus, a distance of 3¼ miles, the railroad has only to climb 495 feet, the gradient thus being a comparatively easy one. The train is hauled by an electric locomotive. The whole journey from Mürren to Lauterbrunnen, including the negotiation of the cable section, occupies 55 minutes, and the fare charged is 75 cents.

CAR CROSSING A STEEP VIADUCT ON THE LAUTERBRUNNEN-GRÜTSCH ALP GRAVITY CABLE RAILWAY.

A water ballast tank below the car is filled when the car reaches the top, thus causing it to descend and raise the other car owing to the difference in weight.

One of the oddities of our nomenclature is that the combination of metals known as German silver contains no silver in its composition, and is of Chinese and not of German origin, says the American Machinist. It was first introduced into Europe by the Germans, and for some time it was not generally known that they had simply borrowed it from the Chinese.