EXPLORATIONS IN PATAGONIA.

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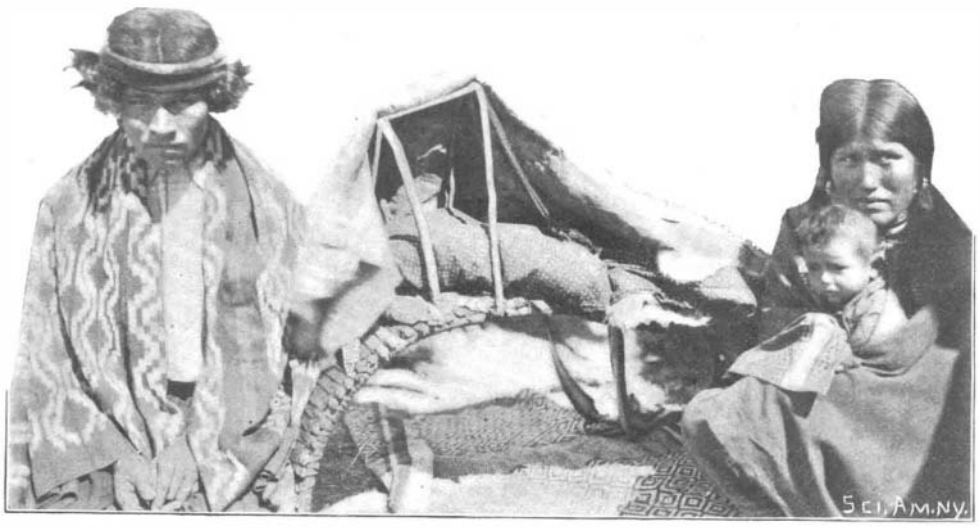
The interest of the scientific world in the extinct life of Patagonia dates from the publication in the early forties of the reports of Owen and Sowerby on the collections of fossil vertebrates and invertebrates made in that region by Darwin during the voyage of the "Beagle," from 1833 to 1836.



Tehnelche Man, Squaw, and Child.

Notwithstanding the interesting and unique nature of most of the fossil mammals in Darwin's collection, so entirely different from everything known in the northern hemisphere, yet the interest aroused by his discoveries was permitted to subside, and for many years almost nothing was done toward bringing to light the exceedingly rich extinct fauna of this distant and little known land.

During the eighties interest was again attracted to this region by the explorations of Moyano, Moreno, Burmeister, Lister, and others.

Interesting and important as were the results attained by each of these expeditions, they were really insignificant from a paleontological standpoint as compared with the brilliant achievements of Charles and Florentino Ameghino. The combined efforts of these two brothers will always stand as a monument to South American paleontology and as a substantial testimony of what men endowed with an enthusiastic zeal for their profession may accomplish even under most discouraging circumstances.

The beginning of the first systematic investigation of the paleontology of Patagonia dates from the first voyage of Charles Ameghino in 1887. Since that time a series of papers written by Dr. Florentino Ameghino upon material collected by his brother in the field have followed one another in rapid succession, each almost invariably announcing discoveries more remarkable than the preceding.

The discoveries announced by the Ameghinos were of such an interesting nature, and many of the conclusions drawn from them were so extraordinary and frequently so opposed to conclusions believed to be well established by observed facts in the northern hemisphere, that paleontologists everywhere agreed as to the desirability of bringing together a representative collection of fossil vertebrates and invertebrates from that region for study and comparison with collections from North America and Europe, and of making, in so far as possible, a detailed study of the geology of that region, sufficient at least to determine the exact sequence and relations of the different horizons, and of securing all data possible which might prove of use in correlating South American rocks with those of North America and Europe.

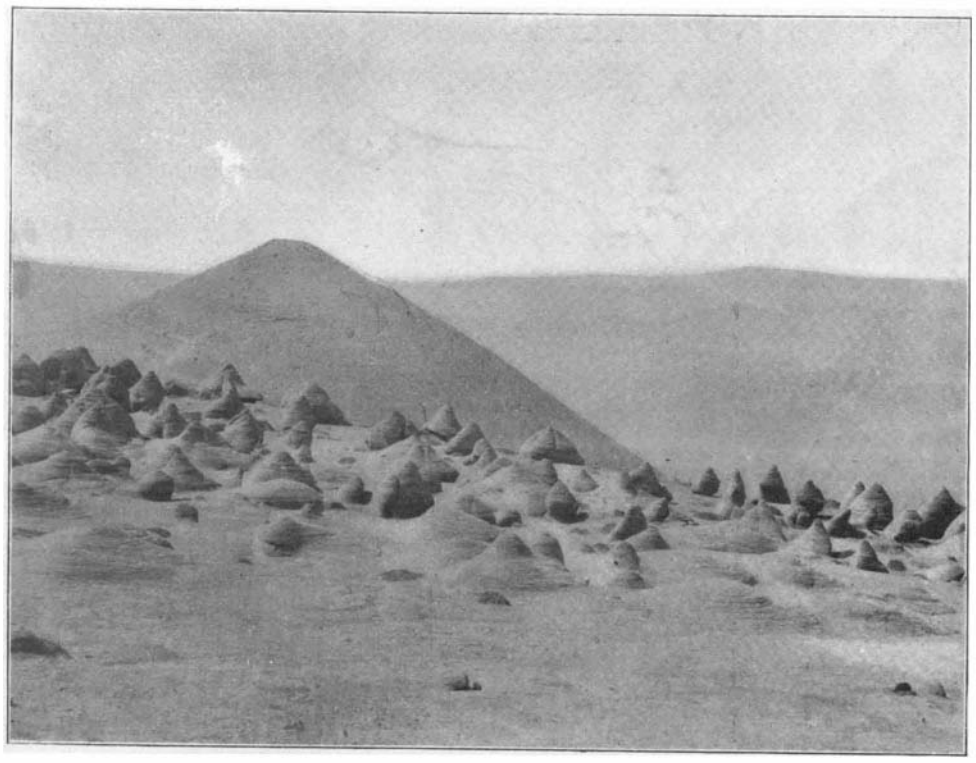
Since no one else seemed ready to undertake this work, early in the autumn of 1895 the writer decided to attempt it in behalf of the department of paleontology of Princeton University. Dr. W. B. Scott heartily approved of the plan when it was presented to him, and freely gave his energy and influence toward its accomplishment, while from several friends and alumni of the institution came most essential financial assistance. So that by March 1, 1896, I was able to sail with Mr. C. A. Peterson on our first expedition. Since that date the work in Patagonia has been continued with but occasional interruptions.

It would be quite beyond the limits of this article to give in detail the results of the work so far accomplished or to discuss any of the many controverted questions relating to the geology of that portion of South America. A brief account of the physiographic, geologic, and paleontologic features of the region, together with a summary of the more important results of the work so far accomplished, may be of interest to readers of the SCIENTIFIC AMERICAN.

Physiographically, Patagonia is divided into two sharply defined regions—an eastern level and comparatively barren plain and a western exceedingly broken and mountainous region. The former extends eastward from the base of the Andes, where it has an altitude of 3,000 feet to the Atlantic coast, where it terminates in a continuous line of precipitous cliffs 300 to 400 feet in height.

Three distinct features characterize the topography and tend to relieve the monotony of the broad Patagonian plains. The first of these is the series of escarpments, from a few feet to several hundred in height, encountered at successive altitudes as one proceeds from the coast inland toward the Andes. These escarpments have a general trend parallel with the present coast line, and they doubtless mark successive stages in the final elevation of the land above the sea. The second feature is to be seen in the series of deep transverse valleys crossing the territory from east to west and constituting the present drainage system. In so far as my observations have gone, these are all true valleys of erosion. The third and perhaps most striking feature in the topography of eastern Patagonia are the volcanic cones and dikes, and the resulting lava sheets, which, covering extensive areas throughout the central plains, are seen capping most of the higher table lands and frequently descending well down the slopes into the present valleys, while the extinct volcanoes often rise majestically hundreds of feet above the surrounding plain.

In a line approximating the seventy-second meridian of west longitude, the Andes rise abruptly from the plains and form one of the most rugged and in many respects most picturesque mountain chains in the world. Many of the peaks attain an altitude of over 10,000 feet, quite sufficient at this latitude to precipitate most of the moisture in the atmosphere as it is forced over them from the Pacific. Owing to the southwesterly winds which prevail here throughout the year, the atmosphere during its long journey across the Pacific becomes saturated with moisture, which, together with the completeness of the precipitation brought about by the advantageous topography of the western coast, renders this region one with an exceedingly high annual rainfall and consequently luxuriant vegetable growth in striking contrast to the dry and comparatively barren eastern region, where the winds, already deprived of most of their moisture during their passage over the Andes, are usually dry and the annual rainfall correspondingly low. The prevailing winds in eastern Patagonia, as in western, are southwesterly, and an easterly wind of twenty-four hours' duration on the eastern coast is sure to terminate in a heavy fall of rain or snow.

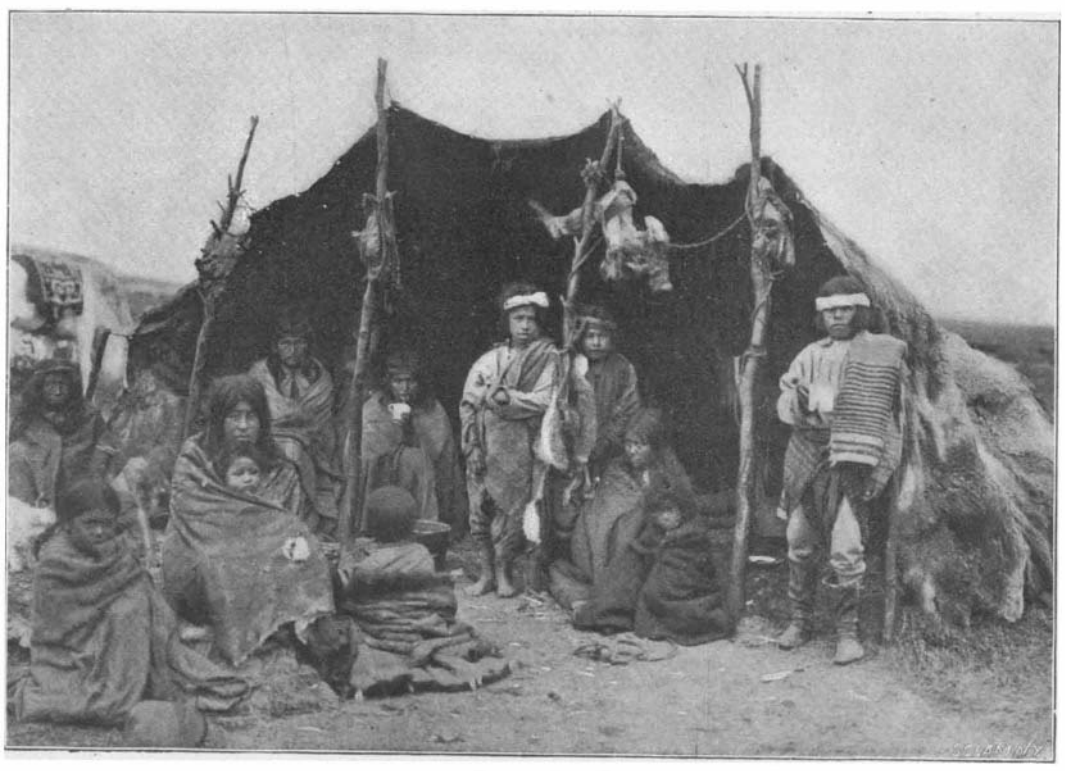


Curious Wind and Rain Erosion in Andes of Patagonia.

Not all the moisture of the mountainous region is precipitated as rain, for in the higher Andes severe snowstorms prevail throughout the entire year, ample for the formation of great ice fields, from which extend numerous glaciers, many of which reach from the mountain summits far down below timber line, and some on the western slope quite into the sea. Formerly these glaciers were much more extensive than at present, and they doubtless contributed to the erosion of the exceedingly intricate system of mountain gorges and fiords now forming so conspicuous a feature of the region.

The slopes of the Andes below an altitude of 3,000 feet are covered with dense forests, especially on the western side. The variety of trees in the southern regions is very limited, and the quality of the wood for lumber or timber for building is poor. Two species of beech, Fagus antarctica and F. betutoides, the latter an evergreen, are much the commoner of the trees. The deciduous beech is especially abundant, and is the only tree found throughout extensive areas on the eastern slopes of the Andes.

Within the dense forests, lichens, ferns, mosses, and other cryptogams grow in great profusion, entirely covering the ground and trunks and lower branches of the trees. The delicate foliage and variety and har-



Tehnelches Taking Yerba.

PROF. HATCHER'S EXPLORATIONS IN PATAGONIA UNDER THE AUSPICES OF PRINCETON UNIVERSITY.

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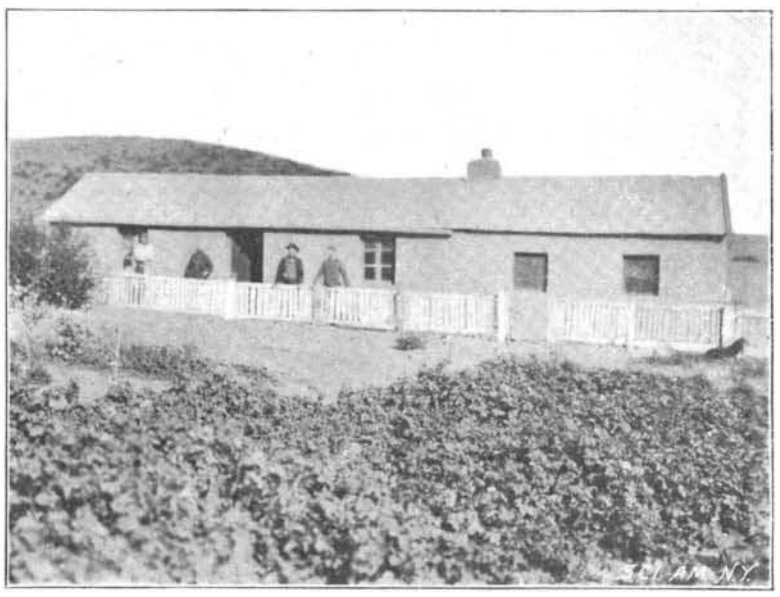
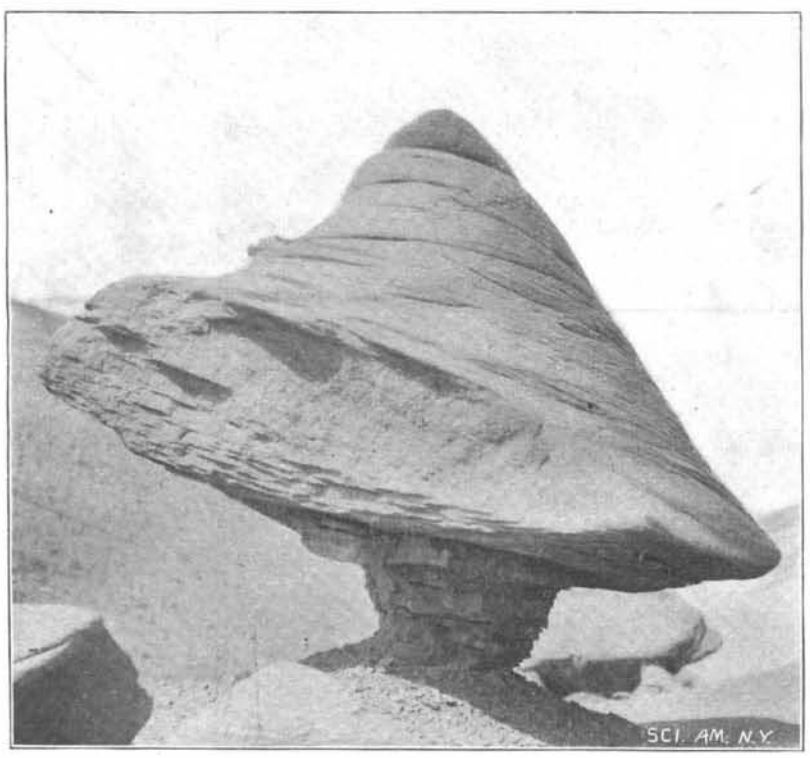
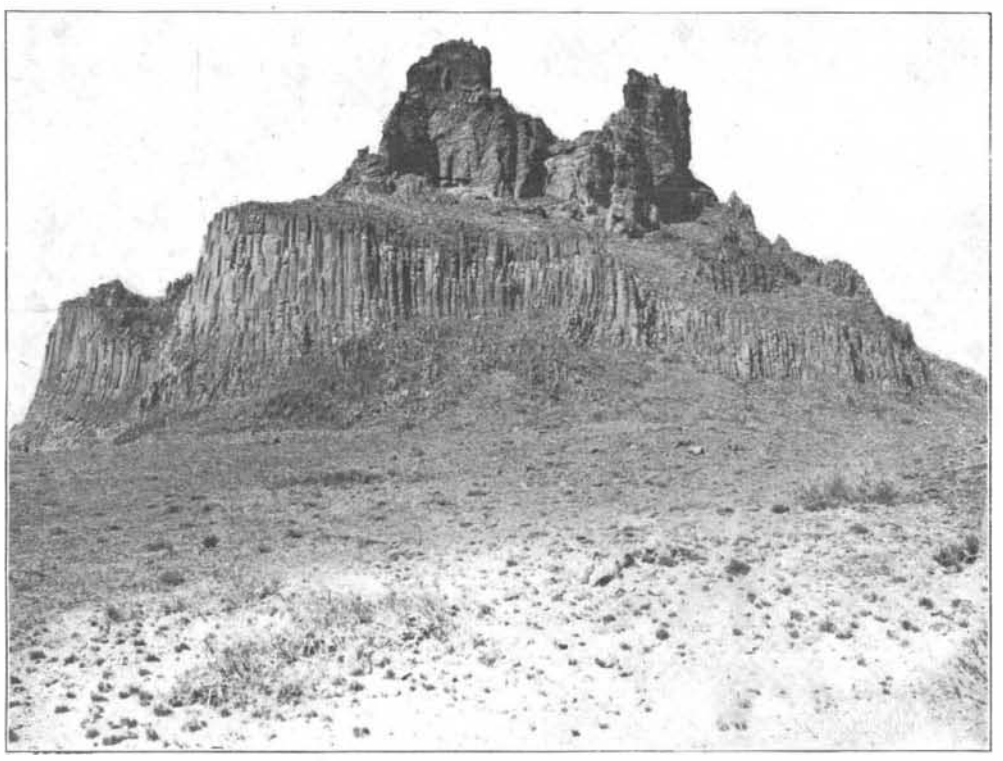
Group of Tehnelches with Two White Argentines.



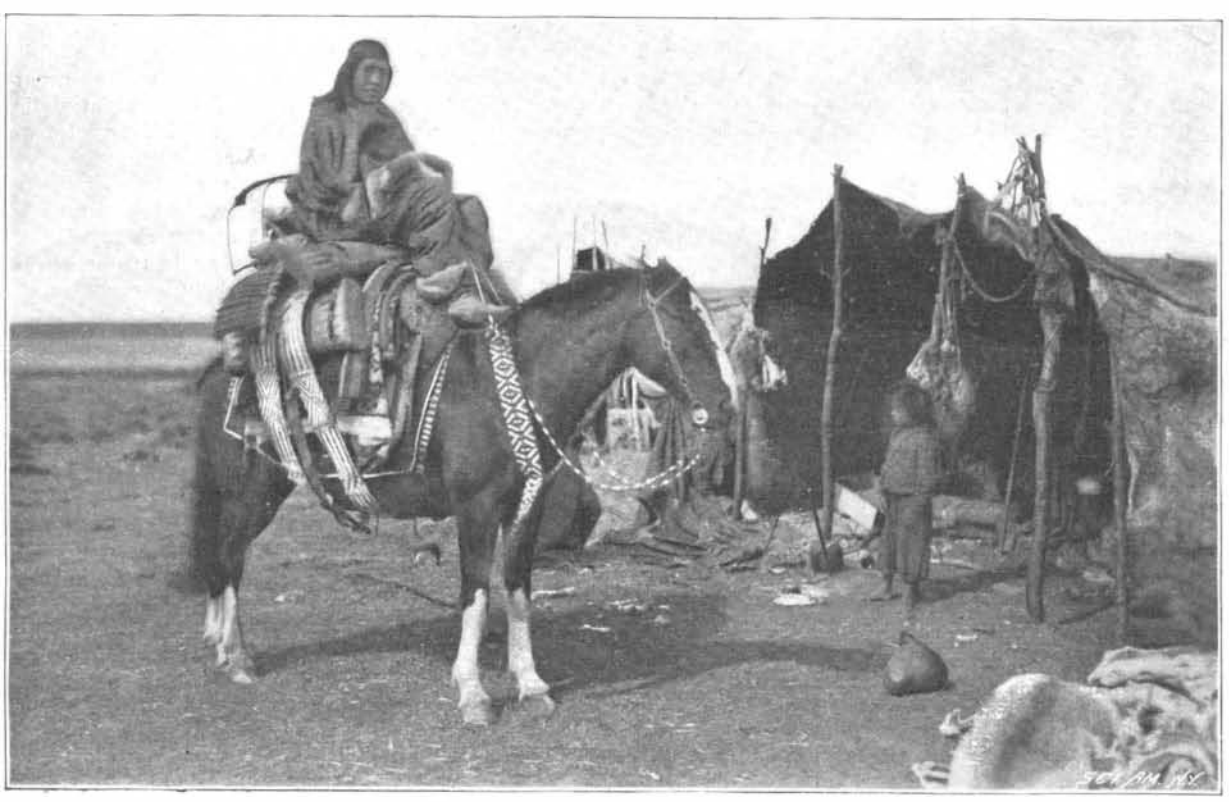
A Sheep Farmer's House in Patagonia.



Balancing Rock Due to Erosion.



Extinct Volcano, Plains of Patagonia.



Indian Woman Ready for the March.

An Old Tehnelche.

PROF. HATCHER'S EXPLORATIONS IN PATAGONIA UNDER THE AUSPICES OF PRINCETON UNIVERSITY.– [See page 328.]

mony of colors of these plants, always freshened by frequent showers, enhance the other natural beauties of this region, and give to the quiet depths of the forests a peculiar attractiveness, contrasting strongly with the rugged cañons and serrated crests of the higher Andes.

The most conspicuous animals of the forest region are a small deer, not quite so large as our Virginia deer, the male with usually only two points on either horn. The puma, or mountain lion, is abundant both on the plains and in the mountains. There are two species of dogs. The larger, Canis magellanicus, is about the size of a small collie, of a reddish brown color, and frequents the wooded regions. It is rather shy, in striking contrast with the smaller C. azare, abundant in the plains, of a light gray color, and about the size of a small red fox. The guanaco or South American camel is very abundant over the plains, and occasionally enters the wooded mountainous districts. Among the birds, two, from their size, are especially noteworthy, the rhea, or so-called ostrich, found in great numbers on the plains, and the condor, common in the Andes, along the high bluffs of the sea coast and about the basalt cliffs of the interior plains region.

The natives of the eastern and western regions belong to two entirely distinct races, differing from each other in their customs, language, and mode of life. To the eastern region belong the Tehnelches, a large, well developed, and peaceable race, living entirely by the chase. They construct their habitations and make their ample clothing with considerable skill from the skins of the guanaco. In the capture of the guanaco, rhea, and other game animals and birds they are exceedingly proficient and show much ingenuity.

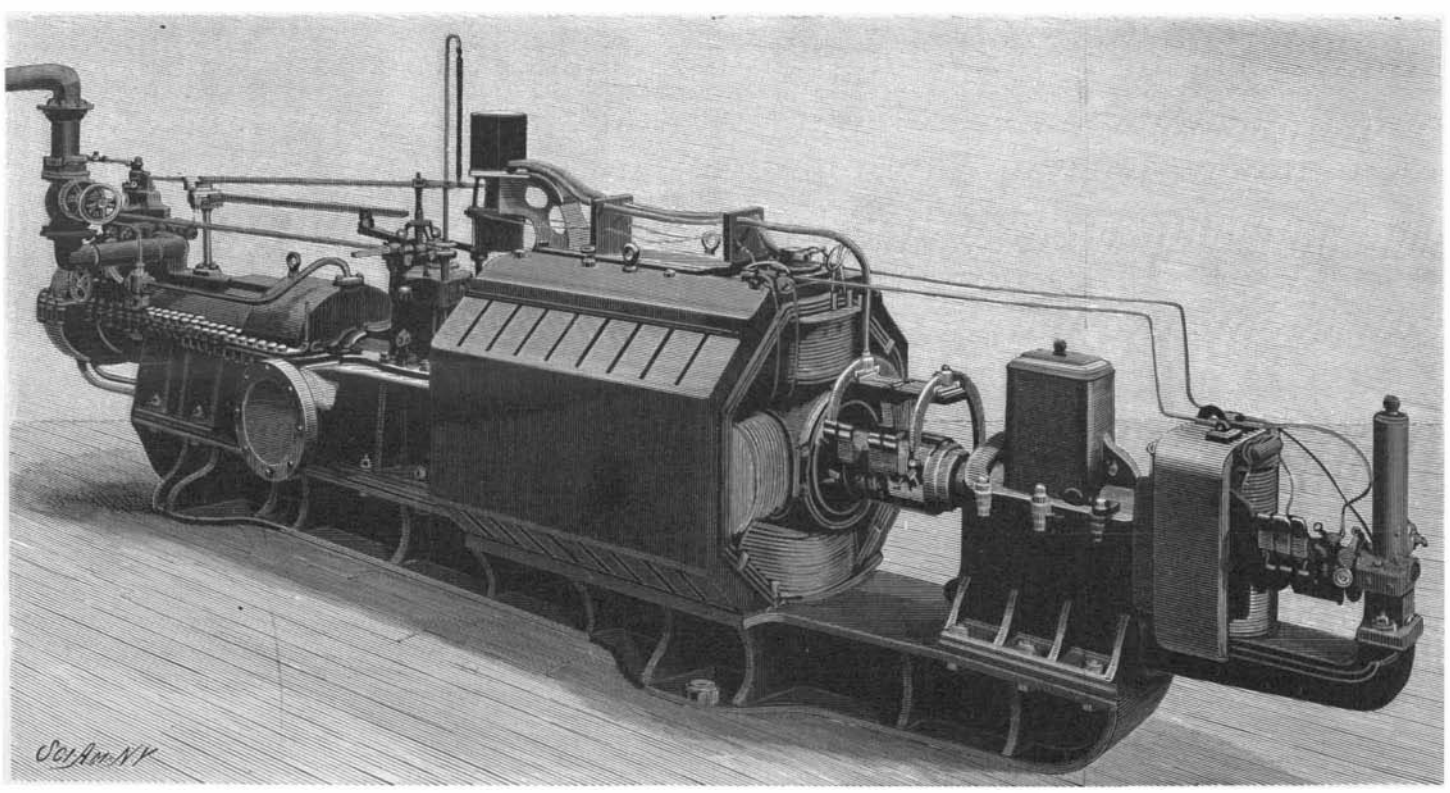
The Channel Indians of the western region are physically much inferior to the Tehnelches. They are essentially a maritime people with all their activities clustering about the shore, from which they never proceed more than a few miles inland. They subsist chiefly upon shell fish. the flesh of seals, fish, and the sea otter and a few edible fungi indigenous to the region they inhabit. From the skins of the seal and sea otter they construct their clothing, usually exceedingly scanty, notwithstanding the inhospitable climate. Rude huts are sometimes built from the branches of trees, but they spend much of their time in small open boats made of beech bark sewed together with whale bone. It is in the construction of their boats and the implements used by them in the capture of seals that they show greatest skill and resource.

Although the plains of eastern Patagonia are exceedingly monotonous and uninteresting to the casual observer, yet they are of the greatest interest to the geologist and paleontologist, for it is the rocks composing them that contain the remains of the extinct animals that in former times inhabited this region. In many places along the river valleys there are extensive exposures of the sedimentary rocks rich in fossil remains, and the high bluffs of the sea coast have proved among the most promising localities for the collector.

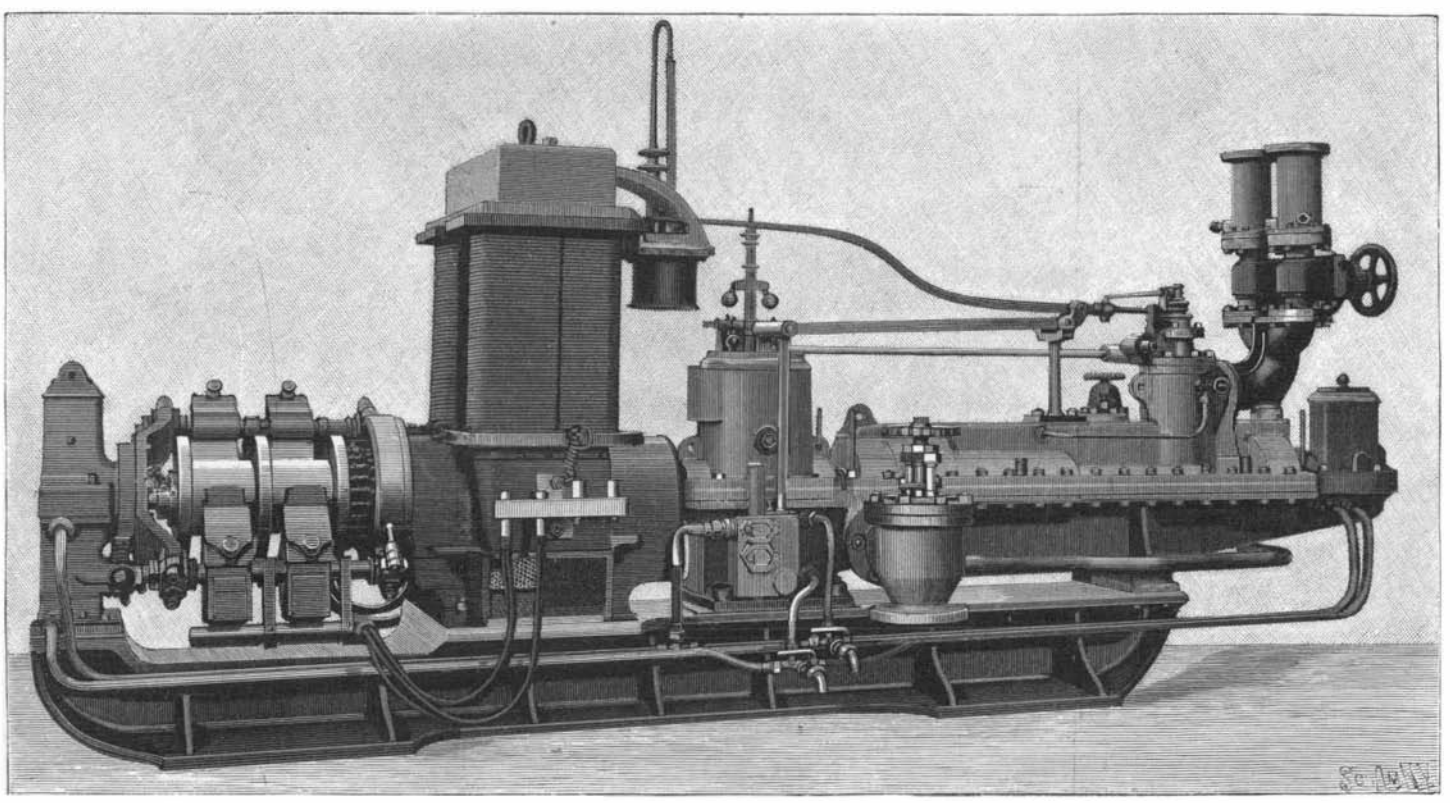
A careful examination of many exposures in various portions of Patagonia has made it possible to establish the exact sequence of the different strata and to give a section of the various formations with the fossils characteristic of each from middle Mesozoic to recent times, and to indicate approximately the present geographical distribution of these different formations throughout Patagonia.

Rich and varied as was the mammalian fauna of South America in former Miocene times, the excellent preservation of many of the skeletons in our collections demonstrates beyond a doubt its unique character, so entirely distinct from anything then living in the northern hemisphere.

While there is a striking and universal dissimilarity between this fauna and that of the northern hemisphere, on the other hand there are many apparently close resemblances between the extinct Patagonian fauna and the recent Australian fauna. The same is also true, though in a more restricted sense, of this fauna and that of South Africa. The explanation of these similarities and dissimilarities in the faunas of the various regions can be best explained by assuming that they indicate in the one case a direct relationship and in the other a totally distinct origin for each. The relations apparently existing between this Patagonian fauna and certain forms now living in Australia and Africa would be the natural result of former land connections between these regions, perhaps, by way of an Antarctic continent permitting of an intermigration of species. The dissimilarity in the North American fauna would indicate a long period of isolation of the two Americas, continuing until comparatively recent tertiary times.



75-KILOWATT TURBO-GENERATOR AT THE HOTEL CECIL, LONDON.



350-KILOWATT TURBO-ALTERNATOR AND EXCITER AT THE METROPOLITAN ELECTRIC SUPPLY COMPANY'S STATIONS.

THE PARSONS STEAM TURBINE.

Although the Parsons steam turbine is identified in the public mind with high-speed torpedo boats, it is a fact that long before the "Turbinia" made her phenomenal speeds the Parsons turbines had been doing highly successful work on land, more particularly in connection with electric light and other electrical installations.

The Hon. Charles Parsons is the son of the late Earl of Rosse, whose great telescope, erected on his estates in Ireland, has long been one of the scientific landmarks of the age. His first successful invention was an epicycloidal engine, in which the cylinders revolve on a trunnion at half the speed of the crank-shaft. It enabled a perfect balancing of the moving parts to be obtained with a resulting high-speed rotation, and in this respect the invention may be regarded as forestalling the present demand for high-speed engines. In 1884 Mr. Parsons commenced the designing of a compound steam turbine and a dynamo with a working speed of 18,000 revolutions per minute. The preliminary experiments showed the necessity for bearings that should be somewhat elastic, and to meet the case the form of bearings shown herewith in Fig. 1 was designed. It consists of a gun-metal tube in which the shaft is rotated, and on this tube are threaded washers which are alternately larger and smaller in size, the smaller ones fitting the bush and the larger ones for the metal standard of the bearing. The whole series of washers is pressed tightly together by a spiral spring and a nut on the bush; one wider washer which is threaded on last fits both bush and standard and forms a fulcrum, with the result that when the shaft deflects a certain amount of elasticity is provided by the shaft itself, though the washers restrict the amplitude of vibration and bring the running to a steady rate about the principal axis of the rotating mass.

This form of bearing was abandoned in 1890 in favor of the simpler arrangement shown in Figs. 2 and 3. It consists of three concentric tubes of brass or steel fitting easily within each other, the oil between the tubes forming a self-centering cushion which has a considerable effect on the vibrations of the shaft. The tubes answer the purpose of the separate washers in the older form of bearing, with the added advantage that the tubes show no signs of wear, the oil film between them being preserved under all conditions of service.

The first successful steam turbine dynamo was constructed in 1885. It was operated at a speed of 18,000