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Supplement of

HMS *Challenger* and SMS *Gazelle* – their 19th century voyages compared

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English translation

of

1. Theil

Der Reisebericht

Die Forschungsreise "S.M.S. Gazelle"

Notes on the translation by Dr W John Gould.

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- manually correcting mis-recognised letters (e.g. the software often confused the characters a,s and u)
- the text was then translated using Google Translate
- the author interpreted the literal translation into text that he believed conveyed the modern-day meaning (free translation or Freie Ubersetzung) and its accuracy has been confirmed by German colleagues.

Conventions adopted:

- Names of individuals are transferred as printed in the original text.
- Where place names have changed, the modern name is added in square parentheses.
- Pagination has been retained as closely as possible.
- Numbered footnotes are as in the original text.
- Footnotes added for clarification of the translation are marked *.

Die

Forschungsreise S. M. S. „Gazelle“

in den Jahren 1874 bis 1876

unter Kommando des Kapitän zur See **Freiherrn von Schleinitz**

herausgegeben

von dem

Hydrographischen Amt des Reichs-Marine-Amts.

I. Theil.

Der Reisebericht.

Mit 58 Tafeln.

Berlin 1889.

Ernst Siegfried Mittler und Sohn

Königliche Hofbuchhandlung und Hofbuchdruckerei

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Preface

In 1874, S.M.S. ,,Gazelle" was sent on a two-year voyage, firstly to carry the German expedition destined for the observation of the transit of Venus in December 1874 to the Kerguelen Islands and to take part in these observations, and secondly to promote oceanography and to conduct physical and oceanographic research in the maritime sciences. However, it was not at the time the intention to summarize and publish the results of the research in a special report; only later, a few years after the expedition, when the rich and valuable material collected on the voyage was assessed, did the need became clear to process it further and to compile it into a unified work. Therefore, after a memorandum had been submitted to the German Reichstag in 1880, the funds for the implementation of this plan were granted. Just as it would have been more advantageous for the preparation and the execution of the work if the intention to create such a thing had existed from the outset and if this had been taken into account when making and recording the observations, so now, after the collected material, came to the fore partly during the trip, partly directly, partly through the intermediation of the Royal Academy of Sciences, to individual scholars for further exploitation, there were not inconsiderable difficulties in bringing it back together and initiating a unified management.

The preparatory work for the publication was carried out up to the beginning of 1886 under the personal direction of the former commander of S.M.S. ,,Gazelle", Kontre-Admiral Freiherrn* VON SCHLEINITZ. When he was snatched from this activity by his appointment as governor of Kaiser Wilhelms-Land [northeastern New Guinea] and the Bismarck Archipelago, the head of the Admiralty commissioned the Hydrographic Office with the publication of the work and under the same the Admiralty Council Captain Lieutenant a, D. ROTTOK with the publication work. This task was not an easy one, firstly because of illnesses of individual employees and also because various work had either not yet started or been completed, so the collection of the material intended for publication was made extremely difficult and impossible. In addition, the funds allocated for the work set rather narrow limits on the scope of the same. This resulted in a considerable reduction of some already completed parts and a few significant restrictions on others, and in some, cases it was necessary to exclude individual sections from publication.

The general plan contained in the memorandum mentioned above has been used as a basis for the arrangement and structure of the work. The work is accordingly divided into four parts[1].

[1] The intention is to allow a fifth part to follow.

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The first part contains a general description of the origins, organization and tasks of the expedition, the equipment of the ship with the instruments required to solve the tasks set and their use, as well as a brief description of the voyage including the observation results in geographical, hydrographic, ethnographic and anthropological areas, and with the use of some interesting results from other branches of research, insofar as this is necessary to complete the picture of the coastal and sea areas described or to fulfill the task assigned to this part, an overview of the voyage and the entire research work grant and an orienting guide for the rest. To divide into parts seemed desirable. For a similar reason, a short description was added at the end of the expedition to the Auckland Islands that took place at the same time as the Gazelle voyage, since the observations of the two naval officers accompanying that expedition were closely related to those of the ,,Gazelle" on the Kerguelen Islands and have been treated with them in the second part of this work.

The first part was processed by Admiralty Councilor ROTTOK from the official reports of the S.M.S. ,,Gazelle" command, the other material contained in the files on the expedition, and the notes and communications made available by some members of the expedition. Of the latter, Professor Dr. STUDER in particular made a wealth of material available, for the section on the Auckland expedition the two members of the same, Sea captain D. BECKS and Lieutenant Captain SIEGEL. Furthermore, privy councilor Professor Dr BASTIAN lent his support and cooperation in a most friendly manner, Dr GRÜNWEDEL, Ober-Bergdirektor Professor Dr VON GUMBEL, Privy Medical Councillor Professor Dr R. HARTMANN, Privy Admiralty Councilor Professor Dr NEUMAYER and Professor Dr WEINEK. Regarding the development and equipment of the expedition, the director of the sea observatory, Privy Councilor NEUMEYER, who in his official position in the Hydrographic Office of the Admiralty was extremely active in the organization of the expedition, had to assure the quality, the required information and contributions, while the content was enriched by an overview of the most interesting results of the mineralogical-geological investigations of the seabed samples collected by the ,,Gazelle", thanks to the Oberberg direktor VON GÜMBEL. Privy Councilor HARTMANN not only took on in the most courteous manner, the processing of the S.M.S. „Gazelle" collected anthropological material, which work is set down in a special appendix. He also succeeded, even after various photographic recordings made on the trip, of an anthropological and ethnological nature, were damaged due to the adverse climatic and weather conditions of the tropics and the sea and had suffered so much from the long storage that they no longer appeared viable for reproduction. The imperfect plates supplemented the areas mentioned with the help of his excellent knowledge - to produce drawings which made it possible to reproduce them in this work.

No less thanks are due to Professor WEINEK, who made available the valuable collection of the drawings and sketches he made as a member of the Venus expedition on the Gazelle voyage; Unfortunately, for economic reasons, only a small part of it could be used.

The gentlemen of the local Royal Museum of Ethnology, Privy Councilor BASTIAN and Dr GRÜNWEDEL were most helpful with the compilation of the ethnological tables and reports.

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In addition to the illustrations already mentioned, the first part includes the maps, plans and coastal views made after the measurements and recordings by SMS ,,Gazelle", as well as course maps for the individual sections, on which, in addition to the course of the ship and the daily location of the same, the winds encountered - and current conditions, as well as the observation stations with the sea depths plotted there are recorded; a further explanation of the same make the explanations given on the same superfluous.

The second part contains the researches falling into the field of physics and chemistry, especially oceanographic observations, the determinations of sea depths, currents, temperature, colour and transparency, the specific gravity, salinity and chemical composition of sea water, and wave observations, mineralogical-geological investigations of the collected seabed samples, tide observations, the magnetic and pendulum [gravity] observations made on board and ashore. The following took part in the processing of the individual sections: Admiralty Councilor ROTTOK, Ober-Bergdirektor Professor Dr VON GÜMBEL, Professor Dr. G. KARSTEN, Dr. O. JACOBSEN, Dr. C. BÖRGEN and Dr. C. F. W. PETERS.

To classify the results of meteorological observations in this part, as was originally planned, had to be given up on account of their great extent. It is intended, however, that the extensive material, which has been completed under the direction of the director of the Naval Observatory, if the means at hand allow it, to be subsequently published in a special fifth part.

In addition to a series of temperature curve and isothermal tables, which graphically represent the temperature conditions of the sea according to their vertical and horizontal distribution, an overview map of the entire route with all observation stations is attached to this part.

The zoological and geological observations and experiences gathered on the expedition are backed up by Professor Dr STUDER, who accompanied S.M.S. ,,Gazelle" on her journey, was active in research in those fields, has been summarized in the third part of this work, after the collections had previously been processed by special researchers. The introductory words given by the author to this part contain more detailed information about it, so that reference can be made to them at this point.

The same applies to the fourth part, which, edited by specialist scholars, contains the results of the botanical research. NAUMANN, who devoted himself to this research during the trip, had set himself the task of collecting plants, proceeding from the correct assumption that in the coastal areas covered by S.M.S. ,,Gazelle" the flora of the flowering plants had in part already been researched several times. On the other hand, the more easily overlooked cryptogams had only been taken into account by some of the earlier collectors, and his attention was given preferentially to the flora of the sea and to the cryptogam land plants. Professor ASCHERSON had been interested in the determination of marine phanerogams from the beginning, but the greatest part was of the remaining collections remained unprocessed until 1883. Thanks to the kind support and efforts of Professor Dr. ENGLER, then director of the Royal Botanical Garden in Kiel, now in Berlin, we have now succeeded in promoting this work as well. Processing of the collected plants was partly taken over by the named gentleman himself, and partly entrusted to other social research through pure mediation.

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The Diatomaceae had already been referred to Director JANISCH in Wilhelmshütte. Professor ENGLER succeeded in getting the following gentlemen: Professor Dr. ASKENASY, Baron F, Von THÜMEN, Professor Dr J. MÜLLER in Geneva, Dr. KARL MULLER in Halle, Dr. GOTTSCHE, Dr. M. KUHN, Professor E. HACKEL, Dr. F. KRÄNZLIN, Count SOLMS-LAUBACH, O. BOECKELER, Professor L. RADLKOFER, Cas. DE CANDOLLE, E. MARCHAL, A. COGNIAUX and E. KÖHNE. He worked on most of the siphonogams himself. Since the collections had been kept in ten different flora areas and for several of the same complete flora did not exist, some years passed before the various collaborators could complete the determination and processing of the plant collection.

It caused great embarrassment when Dr. GOTTSCHE, who had studied the very extensive and valuable collection of liverworts, suddenly fell ill and could not finish his work. Finally, private docent Dr SCHIFFNER found himself ready in Prague to finish the work. The painstaking processing of the Diatomaceae, to which Director JANISCH had devoted himself tirelessly for years, came to a very regrettable state after a number of interesting and valuable tables of the Diatomaceae he had identified had come to a standstill due to ongoing illness it has not yet succeeded in completing it; In order not to postpone the publication of the work any longer, unfortunately it had to be temporarily refrained from recording it and from its publication.

We would like to take this opportunity to express our most heartfelt thanks to the gentlemen employees, as well as to everyone who supports the work in a spirit of co-operation.

If in this work the researches of S.M.S. ,,Gazelle" in the scientific field of the public are ignored, it must be pointed out for a correct assessment of the same that the ,,Gazelle" could by no means exclusively devote itself to these researches, but that at the same time, like any other warship had to solve military and political tasks, which naturally had to push the scientific work into the background; furthermore, the ship had no scientific staff of scholars attached to it, as was the case on other similar expeditions - only Dr STUDER, as already mentioned, accompanied the ship on its voyage as a member the Venus expedition, but that all scientific work had to be carried out by the officers on board in addition to their other ship service.

Berlin, December 1889.

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Chapter I.
Prehistory, purpose and organization of the expedition.

Following the observations of English and American research expeditions in the (18) fifties and sixties, new information about the physical-organic conditions of the seas has been made available; especially through the discovery of life at great depths in the sea and among them new species. These new avenues of study stimulated new general interest in oceanic investigations.

Before that time, attention had been given to the study of the liquid covering the greater part of the earth's surface. This was especially through great expeditions of discovery that revealed a whole series of valuable observations of oceanic conditions and phenomena. However, these continued to be focused on the coasts and near continents and islands even though, more recently, shipping was freed from these narrow constraints. They were extended to the open ocean on voyages by circumnavigators and explorers but most of the knowledge was restricted to international trade routes.

Only at the beginning of the (18) fifties did a new area of systematic exploration of the seas begin on a strictly scientific basis. MAURY, the director of the National Observatory in Washington, deserves the credit for giving the first impetus to this and for having applied a systematic approach. After collecting oceanic and meteorological observations made by American seafarers between 1840 and 1850, he designed schemes to achieve a uniform observation system, which was given to the American ships to record their observations which were then returned to the central office after the voyage and analysed. Furthermore, following his suggestion, the government of the United States requested other seafaring nations to develop and participate in oceanic and maritime-meteorological research. They were invited to a conference in Brussels in August 1853, at which the first agreements on this were made.

MAURY's efforts were particularly encouraged by the need for cable-laying overseas, which arises from the trade and transport conditions of the new era, and which in turn requires precise knowledge of the depths of the sea, the nature of the seabed and other physical properties of the ocean.

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The research was supported essentially by the progress of technology, which was able to provide the instruments necessary for the investigation of the depths of the sea in greater perfection than before. They received a further extension through the trawling tests carried out in the interests of the large-scale fishing industry, which stimulated a detailed study of all marine fauna and flora with their interesting results contradicting previous assumptions with regard to the limits of organic life in the depths of the sea.

Thus, the need and a keen interest in the development of this new branch of geography emerged everywhere, which was initially documented in England and America by sending out special expeditions for this purpose. The most important such undertaking is that H.M.S. "Challenger" was equipped in 1872 and, until May 1876, devoted itself to oceanic research under the most favorable auspices.

As in England and America, in other states which had considerable maritime resources at their disposal, efforts were made to a greater or lesser extent to support the idea of a systematic and thorough exploration of the seas. So, it was understandable that in the relevant circles, which were particularly interested in maritime ventures in Germany, the desire to participate in the above-mentioned investigations manifested itself. However, one had to say to oneself that it would not be an easy matter for the German Navy to enter into ventures of this kind in an appropriate and equitable manner, since the scientific organs of the Imperial Navy, which had just come into being, could hardly have built up the necessary strength to take charge of setting up and running high-profile scientific enterprises with any prospect of success. If you consider the situation of geophysical research in Germany immediately after the founding of the Reich, the difficulty of carrying out an expedition to promote maritime research becomes more apparent. This difficulty consisted mainly in the fact that the workshops for the manufacture of astronomical-physical apparatus were very few and far between at that time and could not be described as being up to date.

No less unfavorable, as in relation to the procurement of scientific apparatus, were the conditions with regard to the recruitment of observers trained in scientific work at sea. The creation of the Hydrographic Office of the Imperial Admiralty remedied this deficiency to a certain extent, but, as already noted, the young institution was not yet strong enough to immediately and fully organize and manage of an expedition for maritime research.

The idea of such an expedition arose from the considerations of these facts, regardless of whether it was in the relevant circles. It was also decided that the spirit of science and research within the Imperial Navy made it one of the nations active in oceanic research. This would benefit and promote the development of our German maritime endeavours.

The passing of Venus in front of the solar disk at the end of 1874 gave a powerful impetus to the realization of this idea. Because of the observation of this phenomenon, which is so rare and so important for astronomy, for which great preparations were made everywhere, Germany also wanted to take part by sending various expeditions, and the navy was to provide them with essential support.

There should be enough space here to say a few words about the transit of Venus and its significance.

The observation of the passage of the Venus in front of the solar disk has for a hundred years has played a great part in astronomy, because it not only serves to produce the most reliable estimate of the distance between the sun and the earth, but also to calculate the distance of all other planets, the orbits of planets and comets and those between the individual celestial bodies The astronomer HALLEY first recognized the passages of Venus in 1677 on the occasion of a passage of Mercury he observed on the island of St. Helena. In a treatise from 1716, KEPPLER drew attention to a passage of Venus in the year 1761, which had already been calculated by KEPPLER and encouraged all astronomers to carefully observe this passage of Venus and to use it for the reliable determination of the solar parallax, which, as is well known, allows both the distance of the sun from the earth and also the true diameter of the sun can be calculated. To determine the distance between two points on the surface of the earth, one uses the means of drawing a base line through the point accessible to one, this must be done precisely and carefully, and then determining the angles which proceed from the endpoints of the base line to the distant point. Forming sight lines with this, and thus obtaining a triangle from which the sought distance can be calculated, this method was shown in the determination of the distance of celestial bodies from the earth the more unreliable and the more delineating the greater the distances of the stars to which they were to be applied. With the help of the earth's radius as the baseline, the distance of the moon from the center of the earth was measured, but to measure the planetary orbits and to determine their distances, the astronomers had to use a longer baseline, and for this purpose the radius or half the minor axis of the orbit of the earth was chosen, by making the observations from different points at which the earth stayed at different times in its orbit around the sun. In this way the radius of the earth's orbit became the unit of length for calculating the orbital lines and the distances of the entire planetary system. In this way, KEPPLER succeeded in first finding the elliptical shape of the orbit of Mars and, through the law named after him, that the squares of the orbital times of two planets are like the third powers of the mean. Keeping distance of the same from the sun, one could now determine the ratio of the dimensions of all planetary orbits to the radius of the earth's orbit, since the orbital times could be determined precisely by observations. This leads to the immediate conclusion that the only thing that matters is the true length of the radius of the earth's orbit, assumed as a unit, or to precisely determine the true distance of a single planet from the earth, in order to be able to specify all questions relating to orbits, their dimensions and their distances with known and measurable masses for the entire planetary system according to the KEPPLER law.

Of the planets that are closer to the earth than the sun, whose parallaxes are therefore greater are than those of the sun and are therefore easier to calculate, especially Mars, Venus and Mercury. Mars approaches the earth every 15 to 16 years in those oppositions which coincide with the perihelion of the planet, at 0.37 the distance from the sun, its parallax is then 24 seconds, i.e. three times greater than that of the sun, so that an error made in this measurement can have a three times smaller influence on the determination of the solar distance than is possible with the direct determination of solar parallax.

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In 1672 the Paris Academy arranged for simultaneous parallax determinations of Mars in Cayenne and Paris, whereby a solar parallax of 9.5 seconds was found. The opposition of Mars was used to a great extent later in 1882 to obtain a reliable parallax determination through the co-operation of many observatories on the northern and southern hemispheres of the earth. According to this observation, the size of the solar parallax was found to be 8.85 seconds. However, due to the considerable size of the Mars disc in the vicinity of the edge, a safe setting is; of the telescope at its center point is associated with great difficulties, therefore errors cannot be avoided when determining the parallax in this way.

Venus in its lower conjunction comes even closer to Earth than Mars, so that the uncertainty of the solar parallax calculated with the help of Venus is four times less than that of the direct calculation. Venus, however, is then between the earth and the sun, therefore turns the unlit side towards the earth, and even if it soon shows a narrow, illuminated crescent, this poses great difficulty in setting the telescope to a certain point.

Finally, Mercury is not very suitable for calculating the parallax of the sun because its distance from the earth does not differ significantly from that of the sun.

It was with great joy that the method devised by HALLEY to use the passage of Mercury or, even better, that of Venus in front of the solar disk to determine the solar parallax was welcomed. If Mercury and Venus are near the earth's orbit at the time of their lower conjunction, they project themselves as small black disks on the sun, and these describe on the same chord, the lengths of which appear unequal from different observation stations, and also the duration the passage at the various observation stations is different. The observations of the transits of Venus are particularly preferable to those of Mercury because the difference between the parallaxes of the Sun and Mercury is two and a half times smaller than that between the Sun and Venus parallax, and because the reliability of the calculation depends on this difference. If one has determined the length and width of two observation stations as far away from each other as possible, and thus their distance, and then calculates the tendons which Venus describes for both stations during its passage on the solar disk, by the fact that one calculates the duration of the through. In the beginning, from the known speed of movement of Venus and from the time of entry and exit on the solar disk, one can determine a point on each of these two chords in which Venus can be seen from both stations at the same time, one thinks if these two points are connected by the arc of a largest circle of the sun, this arc can also be expressed in degrees. If you then draw a straight line through Venus from each observation station to the point of projection on the sun seen from it, so receives. we have two similar triangles in which the arc on the sun is related to the distance of the two stations like the distance of Venus from the sun to that of Venus from the earth. This latter ratio is known from KEPPLER's third law, therefore also the relation of the first two lines. But these also behave like the difference between the sun and Venus parallax and the sun parallax, and since the former is calculated from the observation of the entry and exit of Venus on the solar disk, the solar parallax also results from this.

The most important civilized states had therefore spared no expense in having the Venus passages announced by HALLEY in 1761 and 1764 observed by competent astronomers at numerous suitable stations in the southern and northern hemisphere to be observed. England, France, Russia, Sweden and Denmark participated in it. Unfavorable weather and other inconvenient circumstances thwarted some observations in both years, while others were demonstrably flawed. On the basis of the best observations in 1824, ENKE calculated the horizontal parallax of the sun to be 8.57 seconds, which value was long assumed to be correct. LEVERRIER was the first to raise reasonable doubts against it; From careful investigations of the planetary orbits, he found the solar parallax to be between 8.85 and 8.95 seconds. Likewise, by measuring the time it takes for light to travel from the sun to the earth, FOUCAULT found the solar parallax to be between 8.85 and 8.95 seconds. On these various indications for, the solar parallax has the value of 8.86 seconds. From these various data for the solar parallax it emerges that the doubt about its true value is only a few hundredths of a second, but the uncertainty for the true distance of the sun from the earth is several hundred thousand geographical miles. Therefore, in our century, the passing of Venus in front of the sun was eagerly awaited on December 9th, 1874, all the more so since this time it would have to be visible in a large southeastern part of Asia, in all of Australia, New Zealand and the Antarctic continent. It was to be expected that, due to the careful preparations which all civilized states had made for this purpose, and especially since the instruments intended for observation were significantly improved from earlier, and at the same time due to the spectroscope, several complications, which earlier marked the time of the apparent contact with Venus and made the solar disk unsafe, could now be overcome and completely. especially thanks to the many photographs of the passage of Venus, a definitive, reliable result would be achieved.

In Germany the first suggestion for participation in the observations of the passage of Venus came from the Society of Sciences in Leipzig. At their instigation, the North German Federal Chancellor's Office convened a commission of astronomers from the individual federal states as early as 1869 to advise on the most suitable type of participation and to work out proposals for the same. The expedition plan worked out by the commission was later presented to the Reich Chancellor's Office after the establishment of the Reich, approved by the latter and implemented. The choice of the observation stations to be occupied had to take into account the most favorable geometric conditions for the course of the phenomenon, the accessibility and the possibility of a longer stay there, with consideration of the greatest probability of favorable weather conditions for the observation and those of other countries selected stations are taken.

In the latter respect, the approach was mainly in accordance with the Russian plan of operations, and since Russia set up all of its main stations on its own territory, i.e. in the northernmost areas of the part of the earth's surface affected by the phenomenon, Germany was to occupy mainly south stations. The Macdonalds or the Kerguelen Islands, the Auckland Isles and Mauritius were chosen for this purpose. Even if the Macdonalds Islands offered more favorable geometrical and weather conditions, the Kerguelen, although they had already been considered by the Americans and British for occupation, had to be given preference because of the better landing, residence and climatic conditions. Furthermore, an expedition to Tschifu [Yantai] in northern China and another to Ispahan [Isfahan] in Persia were to be sent to secure the exclusion to the northern group and to complete the whole plan.

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While Ispahan [Isfahan] could be reached by land, Mauritius and Tschifu [Yantai] by mail steamers, the dispatch of expeditions to the two other observation stations, which are located in the southern Indian Ocean, far from all traffic and only rarely visited by ships, encounter major difficulties, and in order to ensure greater security for the undertakings, attention is paid to the support of the Imperial Navy with ships and personnel.

The wishes and suggestions submitted by the Commission of the Imperial Admiralty were fully taken into account by the latter, in a correct appreciation of the importance of the undertakings, as far as the means and the other tasks of the Navy permitted.

A ship was to be equipped for the station on the Kerguelen, which would bring the members of the astronomical expedition with their instruments and all the material around the Cape of Good Hope to their destination, and erect the station there, with his officer corps doing the astronomical work there participate, make trips to neighboring observation stations for the purpose of chronometer comparisons, break off the station after the work is finished and finally transport the astronomers back to Mauritius. From here the astronomers were supposed to return to Europe by mail steamer in order to leave the ship of the Imperial Navy to carry out another task assigned to it. For this purpose, S.M.S. ,,Gazelle" was envisaged.

Since a second ship could not be made available for the Auckland station due to a lack of resorces, the intention was to transport the expedition to be sent there by mail ship to an Australian port with regular contact with Europe and a to charter a suitable colonial mailship to take the expedition to their observation position in the Auckland Islands. The vessel and its personnel were to help establish the observation station on the islands at the same time, during the stay of the expedition there were to carry out various time transfers to Bluff Harbor in New Zealand, where the construction of an American observation station was intended, and finally to bring the expedition back to an Australian port. This expedition was to find support from the Imperial Navy by being accompanied by two naval officers who would provide assistance in nautical matters, take on the management and responsibility for all nautical tasks that arise during the execution of the expedition, charter the vessel for the transport in Australia, take care of the facilities, provisions and the like to be taken on board and take part in the astronomical work itself.

Finally, the corvette “Ancona” stationed in East Asian waters was given the task of assisting the expedition to Tschifu [Yantai] as far as possible and, if necessary, to bring it from Shanghai to the place of observation to support the work there and to make a number of chronometer trips between the Tschifu [Yantai], Nagasaki and Shanghai observation stations.

After the participation of the navy in the astronomical expeditions had been completed, the Imperial Admiralty immediately made sure to continue to use the available opportunity in the interest of geophysical research and to carry out other tasks for the new expeditions in addition to their participation in the astronomical work.

The long stay on the two archipelagos, Kerguelen and the Auckland Islands, allowed the systematic observation of very important geophysical factors, which were all the more valuable given the almost identical high latitude of both stations and a difference in longitude of about 6 hours. It was therefore also ensured that the observations at both stations were carried out as similarly as possible with the same instruments and using the same method. First and foremost, meteorology and climatology should be given in-depth attention, and secondly, magnetic observations were to be carried out both on variation apparatus and on instruments for absolute measurements. The location of the two groups of islands and the system of collecting points of the earth's magnetic force in the southern hemisphere, and almost equidistant from the axis of this system, gave rise to hope that by simultaneous observation at both stations, together with the readings of the Magnetic Observatory in Melbourne, would give valuable results concerning the disturbances in the terrestrial magnetic elements. The establishment of these stations was based on the same idea to which the international observation system in the polar regions, which was inaugurated a few years later, owed its development, and since the equipment of the instruments was essentially based on the same principles as those used in international polar research, took place, so the two expeditions can in a sense be seen as models and forerunners of the stations of International polar exploration expeditions.

Furthermore, the length of the seconds pendulum was to be determined, which had to be of particular importance for determining the shape of the earth, since only very sparse observations have been made in the southern hemisphere.

The tidal phenomenon had to be taken into account in the same way by observations by means of self-registering gauges, since one could expect valuable contributions to the laws about the propagation of the tidal wave in an ocean extending at that latitude around the whole earth.

In addition to these activities to be carried out on land during the stay on the Kerguelen, the „Gazelle" should, on her journey there and, after completing her task there, on her world tour, preferably engage in the field of oceanic research, in particular by measuring the depths of the sea, by observing the water temperature from the surface to the bottom, the specific gravity and the salinity of the ocean water, the currents on the surface and at different depths, through the collection of water samples for later precise analysis of the sea water, and of bottom samples for the determination of the mineralogical-geological as well as the chemical composition of the seabed, as well as through studies of marine organisms, fauna and flora of the ocean.

At the same time, the meteorological and magnetic observations should be carried out with special care during the whole voyage, so as to expand geographical knowledge and in the interest of shipping, world traffic and civilization, especially those areas should be visited which are little known, but which perhaps could be opened up for the purposes of civilization by shedding new light on them by research of all kinds, by surveying and recording of the coasts and the surrounding waters, by anthropological and ethnological studies and collections, wherever opportunities arose, the depths and dangers of navigation were examined, new sea roads checked and other hydrographic work carried out.

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The departure to the Kerguelen had to be accelerated somewhat in order to meet the deadline needed for the timely arrival there for the observation of the passage of Venus, and the oceanographic research, as well as the stay at the coastal places and islands to be approached on the way, had to be limited to a certain extent. But this voyage through the Atlantic Ocean, with its in part already known conditions of depth, temperature, and currents, offered on the one hand the best opportunity to gain the necessary practice in observations of this kind and to check the measurements made, on the other hand to complement the previous observations, especially those of the ,,Challenger".

The German African Society for the Exploration of Central Africa, which had sent an expedition to the Loango [coast in May 1873, which - as is well known - was followed by a mishap right from the start (shipwreck of the ,,Nigretia" on June 14th 1873), had asked His Excellency the Chief of the Admiralty, to facilitate and promote the purposes of the expedition by occasionally sending a warship to those areas. In order to meet this wish, S, M, S, "Gazelle" should enter the mouth of the Congo on their journey through the South Atlantic Ocean in order to work in Banana to strengthen the reputation of the expedition and the Chinchozo station, and to give the station's investigations a basis of increased value by making observations.
.

During the stay of the astronomical expedition on the Kerguelen, the ,,Gazelle" had time to carry out deep sea research in the area around the islands and to carry out interesting hydrographic work on an its way south, which provided valuable information about the water circulation and the physics of the ocean at that high latitude.

The rest of the "Gazelle" voyage after the completion of its task on the Kerguelen, and after it had taken the members of the astronomical expedition to Mauritius, had to be made dependent on the success or failure of the observation of the Venus passage, as the length of stay on the Archipelago defined the time left for the trip.

A perfect picture of the whole itinerary and the tasks S, M, S. ,,Gazelle" are given by the sailing regulations and instructions given below, which we can therefore refer to here.

After His Majesty the Emperor had approved the commissioning of the S.M.S. ,,Gazelle" for scientific purposes on March 10, 1874, the next concern of the Imperial Admiralty had to be to make the most extensive preparations possible for the expedition. The These were done as well as possible in all respects and so as to facilitate completion of the objectives as well as possible. These preparations had to include the procurement of the instruments and apparatus necessary for the various researches, the setting up of instructions and the preparation of the personnel.
From the outset, the intention was to include in the plan for the observations everything that might appear desirable and feasible from recent research findings. Accordingly, the efforts of the Imperial Admiralty were directed towards engaging interested academies, scientific societies, and individual scholars and to ensure their support and advice in carrying out the voayage. The Royal Academy of Sciences in Berlin was particularly approached in this regard.

It may be mentioned here that as early as 1872 His Excellency the Chief of the Admiralty, Lieutenant General VON STOSCH “Rathschlage[2]”), had written to the board of directors of the anthropological society for anthropological investigations, and had placed in the hands of the officers and officials of the Imperial Navy the instruction to use their best efforts to achieve the goals mentioned Society while traveling to assist His Majesty's ships.

On April 30, 1874, the chief of the Admiralty addressed a letter to the Royal Academy of Sciences at Berlin, in which the Academy was informed of the plan for the expedition of S.M.S. ‘’Gazelle”, this was linked to a request that he should be informed of the wishes of the Academy. As a result, the Academy's wishes related to the S.M.S. ,,Gazelle" expedition were compiled and published in a special brochure: "Scientific wishes to be taken into account when drawing up the instructions for SM Corvette" Gazelle ", the head of the Admiralty, Minister of State, etc. His Excellency Lieutenant General VON STOSCH, at his request respectfully communicated by some members of the Royal Academy of Sciences in Berlin; Berlin, May 1874." . We will come back to the individual instruments and scientific equipment in the next chapter. The sailing regulations and main instructions containing the plan and the task of the expedition can also be found in the next section.

In order to prepare the officers assigned to the voyage on board S.M.S. "Gazellc" and to carry out the scientific work, His Excellency the Chief of the Admiralty, together with the two officers envisaged for the expedition to the Auckland Islands, Lieutenant Commander BECKS and Sub-lieutenant at sea SIEGEL, went to Berlin to give them the opportunity to look at the instruments and to become familiar with their use, as well as with the tasks to be solved in the individual areas and the type and method of execution. In the premises of the Admiralty facilities had been made to set up the various instruments and to carry out investigations and observations with them.

In order to eliminate uneven observation and recording in the field, excursions were made to the area around Berlin and magnetic observations, triangulations using the heliotropes, barometric height measurements and so on were made.
The exercises were carried out by the hydrographer of the Admiralty, Dr. NEUMAYER, who also had the task of presenting the objectives of the expedition and the work to be carried out during the same to the officers. While the officers destined for the "Gazelle" had to embark at the beginning of June, the two gentlemen of the Auckland expedition were able to continue their preparatory work into the first days of June in order to then travel directly from Berlin via Brindisi and Suez to Melbourne, and from there to their destination.

[2] Advice on anthropological research on naval expeditions. Prepared by the Berlin Society for Anthropology, Ethnology and Prehistory at the instigation of the head of the Imperial German Admiralty

Chapter II.

Commissioning and fitting out of S.M.S. ,,Gazelle"

Ship description. Facilities for the expedition. Ship occupation. The ship's staff and their participation in the observations. Venus Expedition personnel. The scientific instruments and their uses. Deep sea explorations; Ordinary Sounder: Sounder with chamber; Sounder from BAILLIE: the HYDRA-Sounder; Sounding lines, accumulators, sounding. Water temperature regulations; Depth meter from MILLER-CASELLA; Deep sea thermometer from NEGRETTI-ZAMBRA. Water samplers; Apparatus from MEYER. Determination of the specific gravity of the sea water. Determination of the transparency of the water. Current measurements. Water level observations. Towing equipment. Meteorological observations; the deviation magnetometer; Astronomical and geodetic work.

In accordance with the Highest Cabinet Order, S. M. S. "Gazelle" was put into service at the Imperial dockyard in Kiel on June 2, 1874 with a flag parade in the morning at 8 o'clock under the command of the Captain of the Sea Baron VON SCHLEINITZ, who immediately set about rigging, repairing and equipping the ship with all his energy. S.M.S. ,,Gazelle", although not one of the very latest ships of the Imperial Navy, was one of the best and most suitable vehicles for the purposes of the expedition in terms of space and size, in terms of facilities and sea characteristics. Built entirely from wood, it belonged to the class of "covered corvettes", now called cruiser frigates, and as such offered a spacious, airy and light deck below the upper deck, the battery, which was intended for the placement of the guns Sun and rain equally protected, suitable for scientific work, for setting up work and living rooms.

Laid-down on December 3, 1855 in Danzig, its construction was completed within four years to the point that it could be launched on December 10, 1859, and after the completion of the internal furnishings on June 24, 1861, it was put into service for the first time and in the next year, 1862, to undertake the first voyage outside the Baltic Sea, as far as the English Channel. Further long yoyages soon followed, on which she was supposed to render essential services to the navy and the state under the Prussian, North German and German flags; Particularly noteworthy are the long voyages to East Asia 1863-1865, to the Mediterranean 1866-1867 and to West India 1871-1873.

At 58.22 meters long, 12.79 meters wide and 6.59 meters deep in space, a draft of 5.26 meters forward and 5.75 meters aft, the tonnage of the ship in 2015 was tonnes; an engine of 1300 indexed horsepower and with an ordinary two-bladed propeller could give it a speed of 9-10 nautical miles per hour while under sail and steam; as well as a much higher speed of up to 13.5 nautical miles was achieved under sail alone. With a cool, fresh breeze (wind force 6 according to the BEAUFORT scale) the ,,Gazelle" ran at a speed of 11 to 12.5 knots, (or as many nautical miles per hour), with wind force 7 to 8 under full sail 13.3 knots Also under sail, and this is a very important property for larger overseas expeditions, the ship sailed well, namely on 5 to 5.5 points off the wind[*] with a speed of up to 8.5 knots.

The rigging (fully rigged) and the other equipment of the ship correspond to those generally used for that ship class and therefore do not require any further discussion.

[*] 4 points off the wind is 45°

It was necessary to provide space for the accommodation of the Venus expedition with all its extensive apparatus, both for the observation instruments and for the material for the living and observation rooms to be built on the Kerguelen, as well as for the other tasks of the ship necessary instruments, for the scientific work itself and the collections. Ando so in order to gain space for provisions and other items of equipment on the likely long sea voyages without stopping at inhabited places or places where it was possible to supplement the ship's equipment, the armaments of the ship were halved, the crew reduced by 50 people, and special arrangements made for the purposes just mentioned. The guns left on the ship were a 15 cm marine ring cannon aft and eight 15 cm naval cannons in the battery. For this purpose, a large study and dining room, five living and sleeping chambers and two chambers for storing the astronomical instruments were set up on the latter deck.

While the regular crew was 390 including officers, only 338 were on board.

The ship's staff consisted of:

Captain at sea (now Vice-Admiral ret.) Baron **VON SCHLEINITZ** as commandant.
Lieutenant Captain (now sea captain) **DIETERT** as first officer.
Lieutenant Captain **JESCHKE** (died on August 2, 1879) on board S. M. Kr., “Nautiluss” in the Red Sea) as navigational officer.
Lieutenant captain (now captain at sea) **BENDEMANN**,
Lieutenant zur See (now captain at sea) **STRAUCH**
Lieutenant at sea (now corvette captain) **RITTMEYER**
Sub-lieutenant at sea (now corvette captain) **VON AHLEFED**.
Sub-lieutenant at sea (now lieutenant captain) **WACHENHUSEN.**
Sub-lieutenant at sea (now lieutenant captain) **CREDNER**.
Sub-lieutenant at sea (now lieutenant captain) **BREUSING.**
Sub-lieutenant at sea (now Lieutenant at sea retired) **VON SEELHORST**.
Sub-Lieutenant at sea (now Kapitänlieutenant) **ZEYE.**
Navy medical officer **DR NAUMANN**.
Marine assistant doctor (now medical officer) **Dr HUESKER**
Navy underpaid master **LINDENBERG**.

Since the time for equipment and preparation was extremely tight, and the individual members could not be expected to prepare themselves in all branches of science for the purposes of the expedition, so care was taken to form groups into which the observation and processing in the individual areas fell. So Lieutenant Captain DIETERT, Lieutenant at sea RITTMEYER and Sublieutenant a sea VON SEELHORST were responsible for the atmospheric measurements, i.e. meteorological and astronomical-physical (zodiacal light, northern and southern lights, meteors, etc.); Lieutenant Captain JESCHKE, Lieutenants at sea BREUSING and ZEYE were responsible for navigation, related to surveying, sounding (except deep sea sounding), shoreline recordings, land scoring, sailing instructions, as well as the astronomical and magnetic observations; Lieutenant Captain BENDEMANN and Lieutenant WACHENHUSEN covered the oceanographic measurements, such as deep sea soundings, sea temperatures, specific gravity and composition of sea water, currents and tides; Lieutenant at sea STRAUCH, Sublieutenants at sea VON AHLEFELD and CREDNER geography, barometric height measurement and pendulum (gravity) observations.

Lieutenant Captain STAUCH also did the ethnological research. Marine Medical Officer Dr. NEUMANN did the botanical research. Marine assistant doctor Dr. HUESKER did the geological and anthropological research.

In addition to the aforementioned gentlemen, Dr. STUDER, curator at the Zoological Museum of the University of Bern (now professor there), took part in the scientific and zoological work during the entire trip. He did not come on board with this intention, but only intended to take part in operations as a member of the Venus expedition. However, from the beginning on the journey to the Kerguelen he showed great expertise in zoological research. He wisely operated and rendered such essential assistance that a further stay on board and a continuation of his successful activity appeared to be of special value for science. After the ship had agreed to do so, an application was therefore made by the ship's command, which was also approved by a higher authority.

In addition, the staff of the expedition to observe the passage of Venus on Kerguelen Island consisted of the board of directors of the Imperial Marine Observatory at Wilhelmshaven De C. BORGEN, who acts as the managing director of the expedition, the astronomer L. WEINEK from Ofen, the Astronomer Dr, A. WITTSTEIN from Munich, the photographer H. BOBZIN from Schwerin and the mechanic C. KRILLE from Schwerin.

The functions and work to be carried out by the individual members were determined by an executive committee of the commission for the observation of the Venus passage. In order to say goodbye to them and to give them the final instructions, the members of the commission met on June 17th, 18th and 19th in Kiel. The embarkation of the gentlemen took place on June 18, three days before the departure of the S.M.S. ,,Gazelle".

The scientific instruments and their uses.

In accordance with the diverse scientific tasks of S.M.S. ,,Gazelle", the complement of instruments and apparatus that had to be provided over and above the usual ship allocation had to be extensive. In the following, they will be grouped according to the types of observation, firstly in order to provide a brief description of the less well-known instruments used and at the same time to give an overview of the various observations undertaken and the manner in which they were carried out on board.

1. The deep sea soundings

For normal ship use, elongated, conical lead weights are used for sounding in shallower water. They have a cavity on the bottom which is filled with tallow when sounding, to which parts of the seabed are supposed to attach themselves, and are thus carried to the surface when the lead is lifted. In the Imperial Navy such sounding leads are up to a weight of 30 kilograms; with lines up to 500 meters in length, which is sufficient for all practical purposes of navigation.

The method used for obtaining basic samples cannot be used at greater depths, because the sample adhering to the tallow is largely washed off again when it is retrieved. The samples thus obtained are furthermore unsuitable for scientific use, because they are contaminated with tallow. Therefore for deep-sea research.

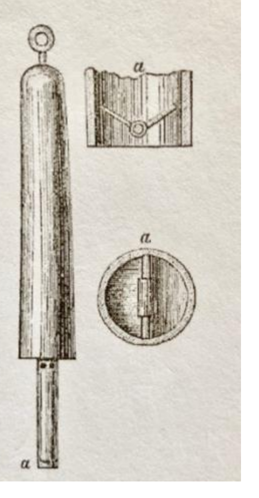
bottom samplers had a special chamber with a valve. S.M.S. ,,Gazelle" had 4 such samplers with the following construction. An iron rod is enclosed in a typically shaped sounding lead, to which a chamber for receiving the bottom sample is screwed at the bottom (Fig. 1). The chamber consists of a hollow iron cylinder about eight centimeters in length, the lower opening of which is closed by a double-wing valve (butterfly valve), while at the top there are several holes under the screw thread. When the sounder sinks, the water pressure keeps the valve open; when the bottom is reached, the pipe penetrates it, and the chamber is filled with sediment, while the water is drained through the upper holes. When hauling up, the water pressure acts from above to keep the valve closed and the bottom sample resting in it is carried up with it.

S.M.S. ,Gazelle" used these sounders, which had a weight of about 45 kilograms, down to a depth of 2000 meters.

A further need, which very soon arose for sounding at greater depths, was the detachment of the sounding lead from the line after the it had touched the bottom, in order to save time and work retrieving it.

As a result, a whole series of devices for this purpose arose.

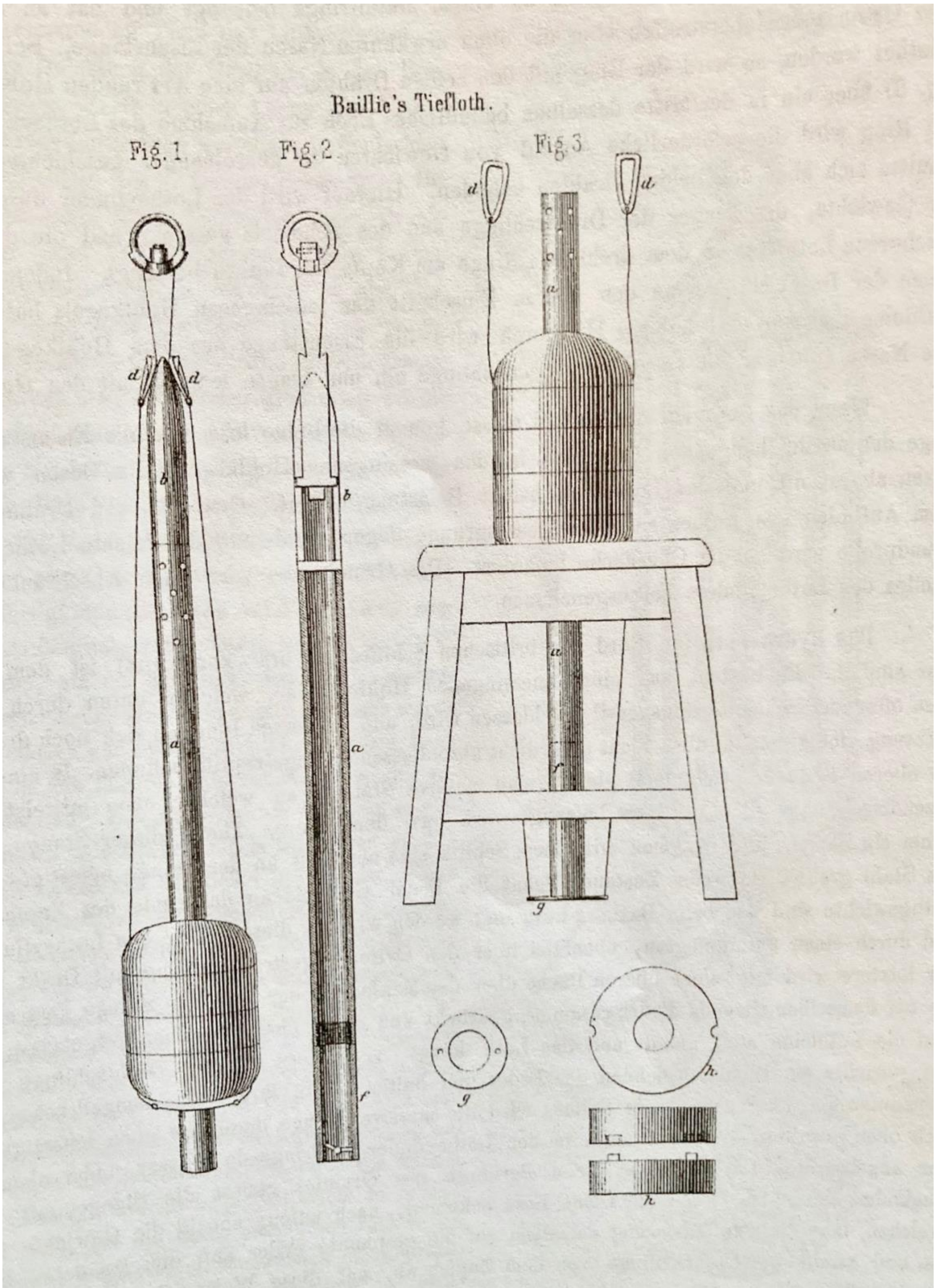
Figur 1.



S.M.S. ,,Gazelle' was equipped with the two sounding devices most commonly used for deep-sea sounding, the BAILLIE-Sounder and the HYDRA-Sounder, with three of the former type and one of the latter. However, the HYDRA-Sounder was only used once, and since it did not work properly, all further measurements at great depths were carried out with the Baillie apparatus. The sounding equipment as well as the deep thermometers were all obtained from England, as there was no experience with this in Germany. With the kind co-operation of the Hydrographic Office in London, all the sounding devices were provided by the Royal Dockyard Chatham and delivered to the ,,Gazelle" when she was in Plymouth.

The Baillie sounder consists of the sounding cylinder, the sounding weights and their suspension device. A brass hollow cone b is screwed onto the upper end of the sounding cylinder a (Table 1), an iron tube 0.65 centimeters in diameter and 1.2 meters in length, in which a square iron rod slides up and down. The same is provided with two opposing noses protruding from a slot in the hollow cone for receiving the eyelets of the wire loop d and at the upper end with a rotatable ring for fastening the sounding line. In the lower unscrewable part of the iron tube there is a double-wing valve which opens upwards when the sounder sinks. Holes made in the upper part of the pipe permit the penetrating water to escape. When the sounder is pushed into the bottom, some of the sediment can penetrate through the open valve into the tube and be held there by the valve which closes when the sounder is drawn up.

The sounder weights are made of cast-iron, are cylindrical and weigh 38 kilograms with dome-shaped weights at each end; these are pierced in the middle in order to stick the sounding cylinder through them, and at two diametrically opposite points on the edge they have recesses for inserting the wire loop intended to hold the weights.


Baillie's Tiefloth.
Fig. 1
Fig. 2
Fig. 3
d
d
b
a
b
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f
d
d
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a
f
g
g
h.
h

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Depending on the depth of the water, which one suspects when sounding, two or more of these weights are placed one on top of the other. To reduce the water resistance, weights of a henispherical shape are placed at the top and bottom, while for those in between, weights of cylindrical shape are used.

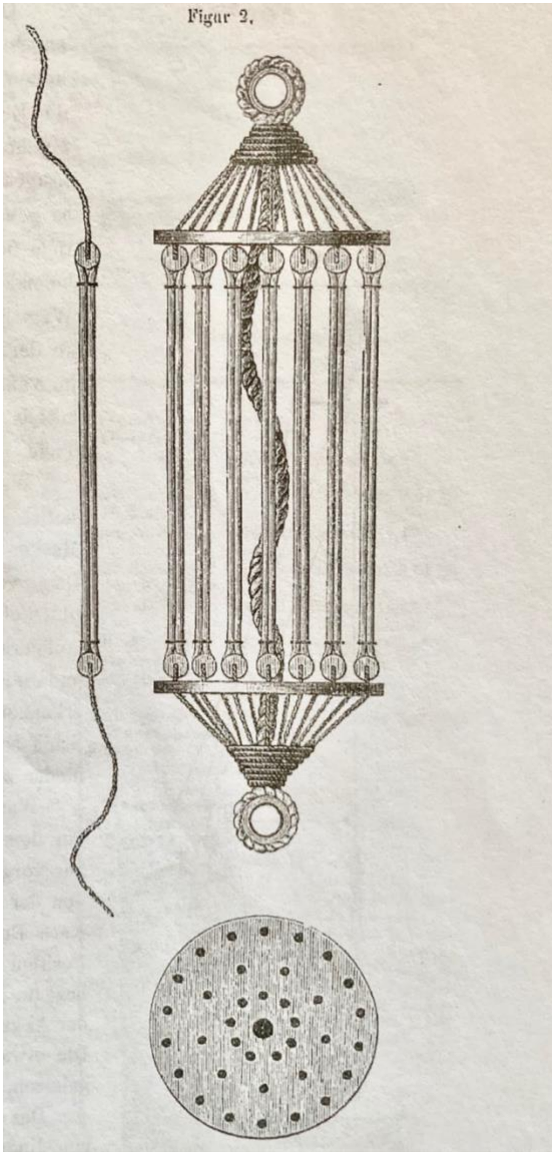
The wire loop is attached to a metal ring at the bottom and has two eyelets at the upper ends for slipping over the above-mentioned noses of the iron rod. If sounding is to be carried out with the apparatus, the ring with the two wires is placed on a kind of round wooden stool (panel 1, Fig. 3) over a hole in the middle to accommodate the sounding cylinder. The required number of weights is stacked on the ring in such a way that their bins are above the two wires. The sounding cylinder is then put through the openings of the weights, the ring of the wire loop and the stool, and the sounding line sheared by a block is attached to the rotatable ring on the head of the sounder. By then holding the eyelets of the wire loop against the upper incision of the brass hollow cone, the sounding line can be slowly drawn up tightly. In this way the iron rod is pulled out of the hollow cone, its nose enters the loop of the wire loop and carries the latter with the weights.

When the sounder hits the bottom, the line comes loose, and the iron rod, due to the weights hanging on it, slides into the brass hollow cone, the eyelets are stripped from the noses and the load is released from the sounder. Weights and wire loop remain on the seabed when the sounder is picked up, and only the light cylinder of sounder with the base sample is carried to the surface. The basic sample is taken out after unscrewing the lower part of the sounding cylinder.

The HYDRA sounder (constructed on board the British ship ,,Hydra") is very similar to the BALLIE-Sounder. It consists of a brass hollow cylinder, which is closed at the bottom by a butterfly valve that opens upwards, and inside of which there are three cone valves that open in the same direction but do not close completely tightly. A massive rod slides in a stuffing box around the upper end of the cylinder, to which the sounding line is attached by means of a ring. On the upper part of this rod there is also a pin through which a strong spring, which is also attached to the rod, engages the steel with a slot. In its free state, the spring expands to the end of the pin. The sounder weights are like the BAILLIE sounder and, like this one, are slipped over the sounding cylinder and placed under it. The ring also slid over the cylinder is held in place with wire; the latter is slipped with its upper part over the peg on the solid rod after the spring on it has been compressed and part of it has been released. After the sounding line has been tightened and the sounder is hanging, the sounder weights tensioning the wire loop prevent the spring from expanding again and hold it in its compressed, now tensioned position. During the fall, the massive rod is held down by the sounding line attached at the top; the water that penetrates the sounding cylinder from below drains through a hole made here; when touching the ground, the bar with the weights hanging on it slides downwards when the line becomes loose. As soon as the weights reach the ground, the force exerted on the tensioned spring ceases, the spring expands again and strips the wire loop from the pin, thus detaching the weights from the sounder.

A sediment sample is pushed through the lower valve into the lower compartment of the cylinder, while the water escapes upwards. Since the almost closed conical valves make it difficult for the water to escape the downward movement of the massive rod, this results in a certain inhibition, the downward sliding of the rod is slowed down, and this gives the part of the sounder cylinder with the butterfly valve, which protrudes below the weights, an opportunity to penetrate the bottom while still under the load of the weights.

The sounding lines delivered by the English shipyard had a length of 10,000 English fathoms and were made from Italian hemp, three-strand, cable lay, 27 yarns. Their circumference was 1 inch. (25.4 mm), the breaking load dry 792, wet 702 kg. These lines were used exclusively during the entire voyage to the deep-sea explorations, without ever breaking. In three cases the line brought 125 kilograms of sounding weights back to the surface from depths of more than 4500 meters when the sounding device had not worked when it hit the bottom. The lines came on board in lengths of 1000 fathoms spooled on small drums and were split in lengths of 125 fathoms with double short splices (cut-splice). On board a drum for 4000 fathoms was made and the line held on this ready for use. Initially it was intended to mark the line in metres in order to indicate the depths in the measure prescribed in the Imperial Navy; however, this was abandoned and the English fathom measure, according to which the depths are given in most of the existing nautical charts, was retained. The line was marked accordingly from 25 to 25(sic) fathoms. As marks for 100 fathoms each, strips of canvas that protruded from the line and showed a consecutive number applied with oil paint were found to be suitable for the purpose. The 25 and 75 fathom marks were marked with blue, the 50 fathom marks with red, with flag cloth tucked into the rope stands.



All deep-sea soundings were carried out from the mainyard, under which a 23 cm patent block for receiving the sounding line was hung. Another important link, the accumulator, was interposed between the yard and the block. The same had the purpose of reducing the jerky shocks and tensions exerted on the line by the movements of the ship, which are inevitable when lying still in the open sea, and rendering them harmless. Such an accumulator consists of, on the ,,Gazelle", 20 double rubber bands, which are inserted between two wooden discs (Fig. 2). In the unloaded state, each of these pairs of strands was 1 meter long, and under a load of 35 kilograms a stretch of 3.1 meters was observed.

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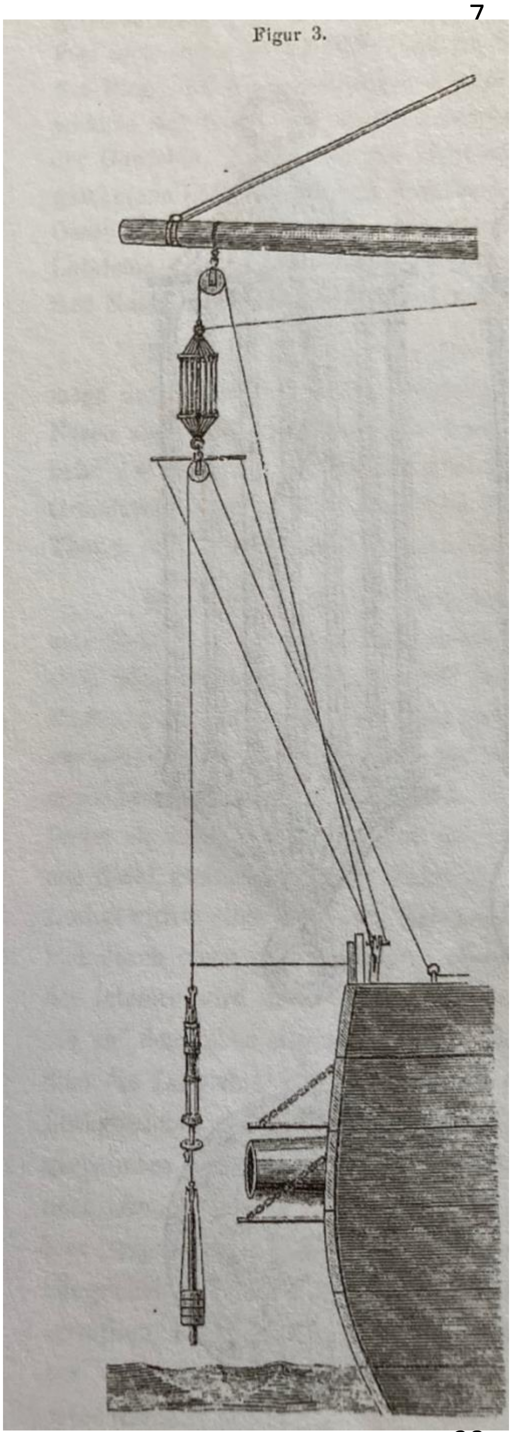
Since the breaking load of the sounding line was 700 kilograms, the extension of the accumulator, if the line was not to be stretched beyond its strength, could never be more than about 3 meters. Accordingly, a strong rope 3 meters long was inserted between the two wooden disks of the accumulator between the rubber bands. As soon as it came under tension, this could be taken as a sign that the tension on the sounding line exceeded an acceptable level.



Figur 3.

Under the accumulator there was a small area with cross beam attached to keep the sounding block always in the correct position. Finally, the sounding line had a by-haul to the rail, as can be seen from the drawing in FIG. 3. The sounding line rigged in this way was then fastened to the ring of the sounding cylinder and the load from the iron sounding weights was selected so that 50 kilograms of weight was provided for every 1000 fathoms of the expected water depth. Above the sounder there was usually a water sampling apparatus - to be described later - and above this two deep-sea thermometers on a line. Fig. 3 shows the sounder with accessories hanging clearly below the accumulator. At first the sounder was lowered about 100 meters by means of the sounding line and then fell freely into the depths.

During the descent, the exact time is noted in seconds, in which every 100 fathoms run out, i.e. as the marks concerned entered the water. The speed at which the line runs out gradually slows as the depth increases, until a sudden change indicates ground contact. With sufficient attention and practice, this moment can also be recognized by the suddenly changing speed of rotation of the sounding winch. During the entire duration of the sounding, the ship must be kept under steam in such a way that the line points up and down.

When ground contact is established, then as a rule the current was determined from the boat prior to rewinding the line. The ship was drifted off the line by the wind and current and the boat was tied to the line.

When these measurements were completed, the ship then resumed its position vertically above the plumb bob and the heaving-in began. Sometimes the strong stretching of the accumulators showed that the weights had not come off. The line that had been hauled in was then allowed to run again, with the release usually taking place.

The line was wound up with the help of a small, single-cylinder, double-acting steam engine, which was set up on the upper deck, in front of the funnel. The same developed at 200 revolutions and 0.7 atmospheric pressure, the horse power indicated about 4.2, which power output could be increased to 5.8 and 9.2 times by gear transmission, if it turned out to be too weak for the tow lines, which were also operated by the same.

In the following we give an example of a complete sounding carried out on board the ,,Gazelle" as well as the other oceanic measurements carried out at the same time according to the records in the sounding journal of the ,,Gazelle", from which the elapsed times of the line can be seen.

Datum: 11. Januar 1876.

No. 138.
Zeit: 1h 50m — 5h 50m p. m.
Wind: OzS — OzN.
Stärke: 4—5.
Wetter: Klar und schön.
Seegang: Dünung aus Ost.
Lothleine: No. 1, englisch.
Gewicht: 125 kg = 5 Stück.
Maschine: Unter Dampf.

Breite: 36° 21,4′ Süd.
Länge: 153° 8′ West.
Barometer: 764,7 mm.
Temperatur der Luft: 19,3° C.
" " Meeresoberfläche: 18,6° C.
Tiefe: 2965 Faden.
Grund: Brauner Thonschlamm.
Oberflächenstrom: SW½S p. C. 1,07 Sm. p. h.; Var. 11° Ost.
Werth der Lothung: Die Leine stand nicht ganz senkrecht, als das Loth Grund hatte.

Faden	Zeit	Intervall	2. Differenz	Vom Fallenlassen	Thermometer: Num. M. Casella	Thermometer: Temper. (° F.)	Thermometer: Temper. ° C.
		m s		h m s			
„Lass fallen"	1h 54m 25s				19709	1) (57,7) (58,0) 2) (51,2) (51,8)	14,28 14,44 10,67 11,00
100	55 1	36	+	36	21158		
200	45	44	8	1 20	21162	(47,5)	8,61
300	56 37	52	8	2 12	19713	(44,2)	6,78
400	57 39	1 2	10	3 14	—	—	—
500	58 45	1 6	4	4 20	21161	(41,6)	5,33
600	59 57	1 12	6	5 32	—	—	—
700	2h 1m 12s	1 15	3	6 47	18488	(40,3)	4,61
800	2 31	1 19	4	8 6	—	—	—
900	3 58	1 27	8	9 33	19052	(38,5)	3,61
1000	5 22	1 24	— 3	10 57	—	—	—
100	6 55	1 33	+ 9	12 30	—	—	—
200	8 32	1 37	4	14 7	21164	(35,7)	2,06
300	10 16	1 44	7	15 51	—	—	—
400	12 11	1 55	11	17 46	—	—	—
500	14 3	1 52	— 3	19 38	—	—	—
600	15 53	1 50	2	21 28	—	—	—
700	17 46	1 53	+ 3	23 21	—	—	—
800	19 42	1 56	3	25 17	—	—	—
900	21 42	2 0	4	27 17	—	—	—
2000	23 40	1 58	— 2	29 15	—	—	—
100	25 42	2 2	+ 4	31 17	—	—	—
200	27 44	2 2	0	33 19	—	—	—
300	29 46	2 2	0	35 21	—	—	—
400	31 51	2 5	+ 3	37 26	—	—	—
500	33 52	2 1	— 4	39 27	—	—	—
600	35 53	2 1	0	41 28	—	—	—
700	37 53	2 0	— 1	43 28	—	—	—
800	39 49	1 56	4	45 24	—	—	—
900	41 43	1 54	2	47 18	21164	(33,8)	1,00
					19052	(34,1)	1,17
3000	44 6	2 23	+ 29	—	—	—	—
100	—	—	—	—	—	—	—
200	—	—	—	—	—	—	—
300	—	—	—	—	—	—	—
400	—	—	—	—	—	—	—
500	—	—	—				

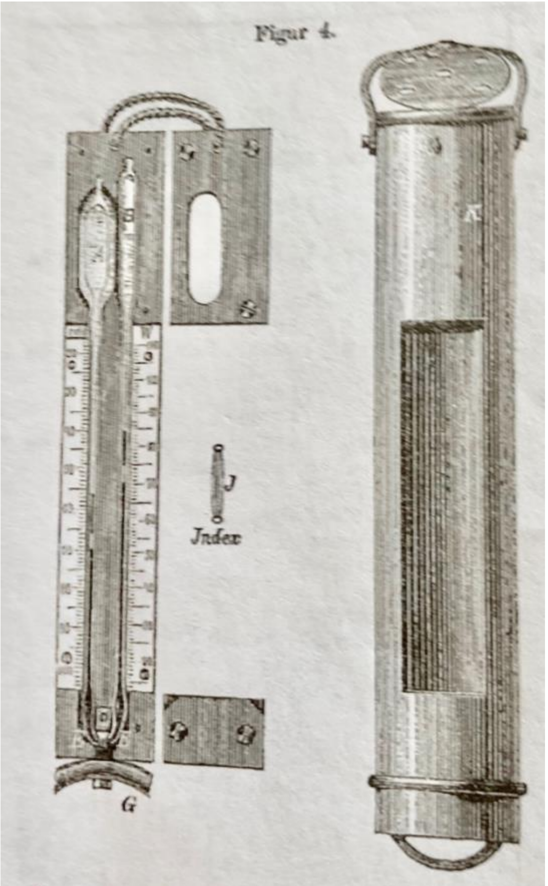
Bemerkungen

Aräometer:
Oberfläche.
Spec. Gew.: 1,02660 Therm.: 18,5°
+ 20
Verb. Spec. Gew.: 1,02680 Salzgehalt: 3,51 %
50 Faden.
Spec. Gew.: 1,02690 Therm.: 17,4°
— 02
Verb. Spec. Gew.: 1,02688 Salzgehalt: 3,52 %
100 Faden.
Spec. Gew.: 1,02695 Therm.: 16,8°
— 14
Verb. Spec. Gew.: 1,02681 Salzgehalt: 3,51 %
Grund.
Spec. Gew.: 1,02710
— 40
Verb. Spec. Gew.: 1,02670 Salzgehalt: 3,50 %
Wasserproben aufbewahrt.
Flasche 71 Oberfläche.
" 72 100 Faden.
" 73 Grund.
Meeresfärbung:
Blau, leicht entfärbt.
Durchsichtigkeit:
340 □cm weisse Fläche: 18 Faden.
Strombestimmung: Oberfläche.
Loggschiff gepeilt vom verankerten Boote aus: SW½S p. C., in ½ Minute 16,5 m aus.
50 Faden. Loggschiff gepeilt von der Boje des Strommessers WSW p. C., in 1 Min. 15 m aus; demnach Strom: SzW½W p. C. 0,67 Sm. p. h.
100 Faden. Loggschiff gepeilt von der Boje des Strommessers WSW p. C., in ½ Min. 11,5 m aus; demnach Strom: Süd p. C. 0,54 Sm. p. h.[3])
Greiner'sche Thermometer No. 2 am Loth angebunden, kam zerdrückt an die Oberfläche.

1) In 50 Faden.
2) In 100 Faden.
3) Die Berechnung folgt Seite 24.

2. Water temperature determinations.

The determination of the temperature of the surface water is simple and is carried out with ordinary thermometers, which you either lower directly into the water, or you scoop up water from the surface and immerse the thermometer in it. For this purpose, the S.M.S. „Gazelle" was equipped with 6 thermometers in wooden frames, by means of which the temperatures were determined in the latter manner.



Determining the temperature at greater depths caused more considerable difficulties. The thermometers to be used for such measurements had on the one hand to be sufficiently protected against the high water pressure in the depths, on the other hand to fix the temperature prevailing at the depth in question, and this information could not be influenced by the varying temperatures of the other water layers through which the instrument passed on its way to the surface. In the earliest attempts to measure deep temperatures, water was either drawn up from the depth in question by a specially designed sampler and a thermometer was dipped into it when it came up, or the thermometer was simply lowered to the specific depth; naturally, both methods produced very unreliable results of little value.

An attempt was made to improve them by surrounding the instruments with poor heat conductors, they were lowered into the depths and exposed to the effects of the surrounding temperature for a long time before they were brought up again. After SIX constructed the first maximum and minimum thermometer in 1778, it quickly found its way into oceanic research and was already used by KRUSENSTERN (1803) and Sir JOHN ROSS (1817) on their great journeys. The principle of this maximum and minimum thermometer has been maintained up to the most recent times, and the improvements which these thermometers have undergone since then relate mainly to the production of a cover to protect against water pressure, not just to prevent breakage of the instrument but also to prevent compression and the excessively high readings caused by this.

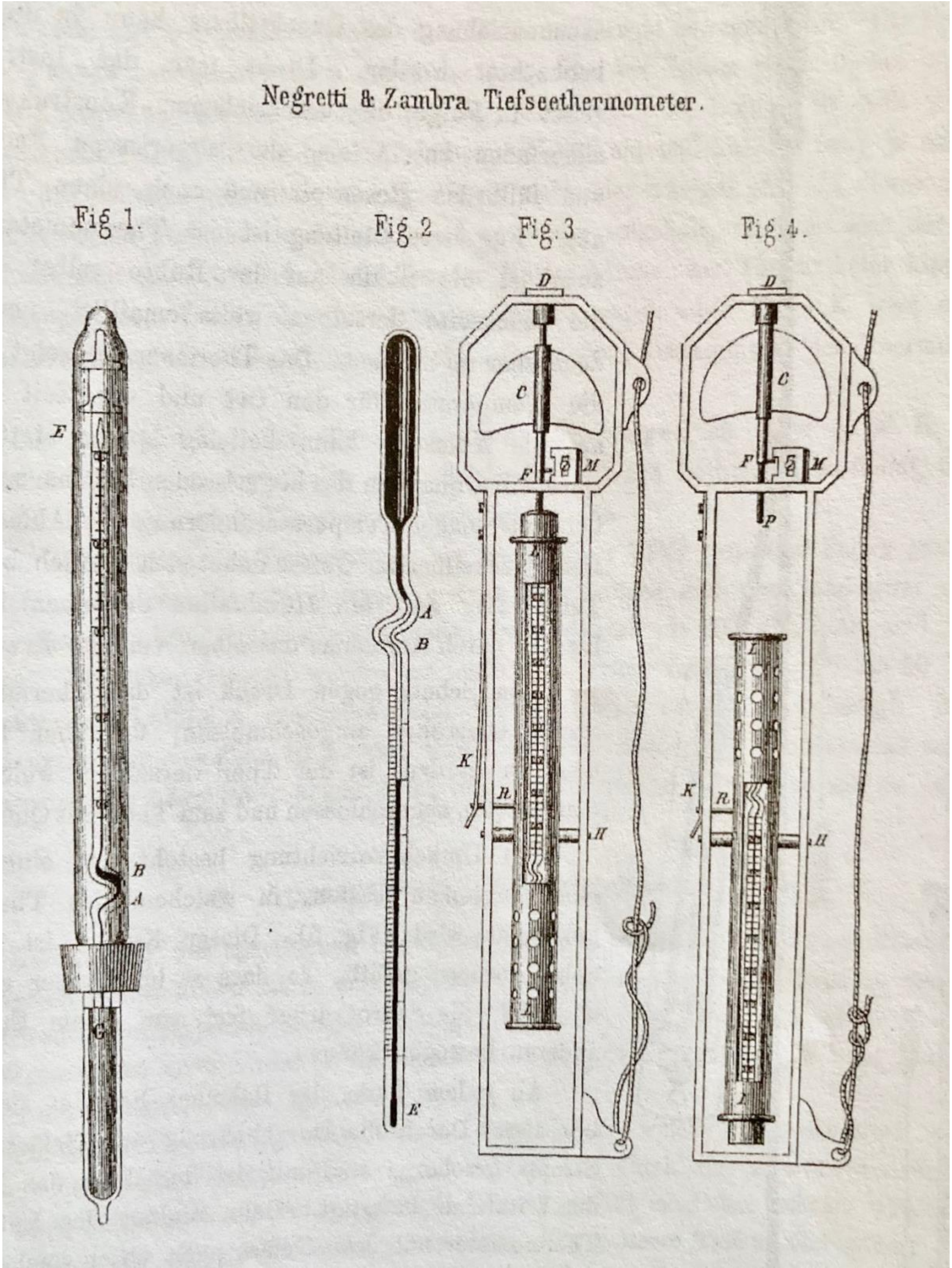
The 22 MILLER-CASELLA thermometers on S.M.S. „Gazelle" are also based on the principle of the SIX maximum and minimum thermometer. It essentially is a spirit thermometer with a mercury thread as an index. The thermometer tube is bent in the shape of a siphon (FIG. 4); at the top of the left leg is an extension bulb, which is filled with an alcohol liquid with a high boiling point; the right limb also has an enlarged chamber at its upper end, which is partly filled with the same liquid and partly contains vapors from the same. In the curved part of the tube there is a mercury thread, which is pushed forward by the expanding alcohol, but when the alcohol recedes, the elastic vapors force it to follow the alcohol again. Above the mercury thread in each of the two legs are index rods (J), which consist of a steel shaft enclosed in a narrow glass tube.

Elastic bristles are attached to the button-like ends of these rods, which press against the inner walls of the glass tubes, so that the index remains everywhere in the thermometer tube if it is not pushed in front of you by the mercury thread.

When the temperature rises, the liquid in the left vessel and limb expands and pushes the mercury in front of it; in the process, however, the liquid passes the left index stick, the lower button of the same thus indicates the state before the increase in temperature, while the index stick in the right leg is displaced upwards with the mercury thread. If the temperature decreases, the liquid recedes, the vapour on the right press the mercury thread further, the index stick on the left is shifted towards the bottom, the stick on the right, on the other hand, stops and shows the thermometer reading before the temperature decrease with its lower end. The temperature is read on a scale which increases according to the work of the instrument on the right side from bottom to top, on the left from top to bottom; If the thermometer is functioning correctly, the respective level can be read from both mercury peaks, while the right index scale indicates the maximum and the left the minimum of the temperature to which the thermometer was exposed. The index scales are moved by means of a horseshoe magnet and, after the reading, are brought back down to the mercury peaks.

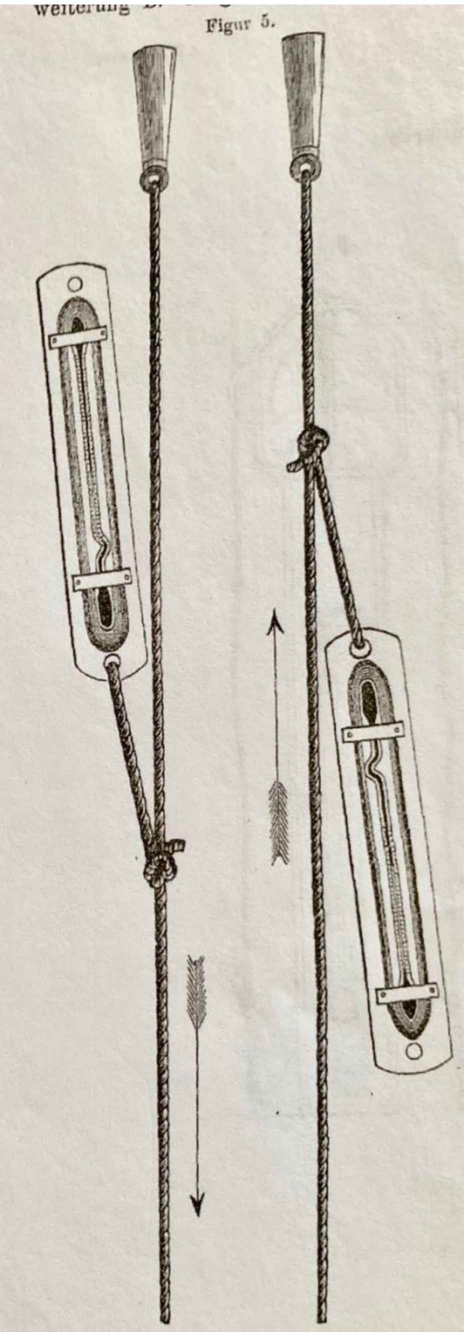
The thermometer tube is made of very strong glass, the vessel is also surrounded by a strong glass cover, so that compression of the same and thus increased reading of the thermometer is excluded. The space between this envelope and the thermometer vessel is partly filled with alcohol. The glass body of the instrument is fastened with copper wire loops on a frame made of hard rubber on which the porcelain scale is screwed. The upper and lower parts of the thermometer are further protected against external damage by screwed-on frame parts. The whole instrument with frame is held by a copper cylinder, which allows the water to flow freely above and below; the thermometer is pushed firmly into the cylinder, and any clearance is made harmless by a compressed rubber buffer G screwed to the lower end of the frame.

Every thermometer used on the ,,Gazelle" was tested by the manufacturer under high pressure; the corrections for pressure were so small that they could be neglected.
A disadvantage of the instrument is that it only registers the maximum and minimum of the water temperature and that any setbacks in the temperature are not indicated. Even if, in general, the temperature decreases from the surface towards the depth, but there are often enough exceptions to this, and even if the thermometer also needs a certain time to equilibrate to the temperature of the surroundings, it can still happen that this instrument has to pass a colder layer of such an extent situated above a warmer water layer that it shows the temperature of the same. These shortcomings should be overcome by a new instrument the
DEEP SEA THERMOMETER from NEGRETTI-ZAMBRA. One such was aboard S. M.S. ,,Gazelle". Since it is based on a completely different principle than the Miller-Casella thermometer and has given very good results in its latest construction, it will also be briefly described here.


Negretti & Zambra Tiefseethermometer.
Fig 1.
Fig. 2
Fig. 3
Fig. 4.
E
B
A
G
A
B
E
D
C
F
M
K
R
H
D
C
F
M
P
L
K
R
H

20

This instrument is a mercury thermometer with an evacuated tube and cylindrical vessel (Table 2). The neck of the latter is peculiarly narrowed, then bent, and the inner tube broadly compressed (A); In the bend there is an enlargement B above the broadly pressed point. In the usual position, when the vessel is held down, the whole tube and part of the reservoir E at the upper end is filled with mercury. The expansion and contraction of the mercury cannot be observed in this position. If you turn the instrument over, the mercury thread breaks off at A as a result of the construction described, the broken thread falls down and fills the reservoir and part of the tube .out. The thermometer is graduated for this position, and the scale is placed on the tube itself and the reverse side of the tube is enamelled in white to make the reading clearer. The thermometer therefore always shows the temperature for the place and the time of the overturning, the reading can take place any later, since the mercury quantum of the torn thread is too low and to change the reading when the temperature changes. The mercury in the vessel naturally expands as the temperature rises, but it is prevented from falling by taking it up from the expansion in B.



To protect against pressure, the thermometer is sealed in a strong glass tube; but in order not to become sluggish as a result, the part of it which surrounds the vessel (G) is closed and part filled with mercury.

The reversing device consists of a wooden frame
or elongated box in which the thermometer is is clamped (Fig. 5). This box is partly filled with pellets, so that it floats in the water, and the pellets can move freely from one end to the other. There is a hole through each end of the frame. A strop is threqded through the perforation at the end of the vessel and the instrument is attached to the plumb line by means of it. When the sounder sinks, the thermometer is drawn with the vessel downwards, when it is caught up, however, with the vessel upwards; it therefore shows the temperature of the depth from which it was brought up.
The instrument in this form is not suitable for depths over 2000 meters, as the wooden case cannot withstand the pressure of the water. A metal frame is therefore constructed for such depths, which at the same time ensures the functioning of the apparatus. In the same (Figures 3 and 4 on table 2) the metal thermometer sleeve L rotates around the axis H, which is attached so that the center of gravity of the instrument lies above it in the upright position, so that the thermometer is in unstable equilibrium is located.

It is held in this position by a screw spindle P which engages in a hole with a nut thread located at the upper end of the thermometer sleeve. The spindle is in connection with a wing C, the axis of which rotates in the bearing D. A small lateral pin F sits on the spindle, which can move between the projections of a cleat that can be moved slightly on the frame. The up and down movements of the spindle are limited by the ejection of the pin against these lower and upper protrusions. In the former position, i.e. H. when the spindle is screwed down as far as possible, it engages and holds the thermometer sleeve; depending on whether the cleat M is pushed up or down, it engages more or more wavily. In this adjustment the apparatus is lowered into the depths; if it is caught up again, the wing C turns, and as a result the screw spindle turns out of the nut, the thermometer tilts over to register the temperature. A spring K attached to the side of the frame pushes a pin R into a slot in the sleeve in order to prevent further movements of the thermometer.

As far as the temperature observations on board S.M.S. „Gazelle" were concerned, the bottom temperatures were always determined at the same time as the sounding, by attaching two thermometers to the sounding line above the sounder.

In addition, the temperatures were only measured up to a depth of 1500 fathoms (since there are still slight changes from this depth down to the bottom), usually to 50 fathoms, then up to 500 fathoms every 100 fathoms, from here up to 900 every 200, and further only every 300 fathoms. The thermometers were attached to a sounding line, weighted with a weight of 25 to 50 kilograms, successively as the line was lowered. After an accommodation time of about 10 minutes, the line was hauled up again with the machine and each thermometer was read and removed and the temperature recorded as it came to the surface.

2. Apparatus for water sampling.

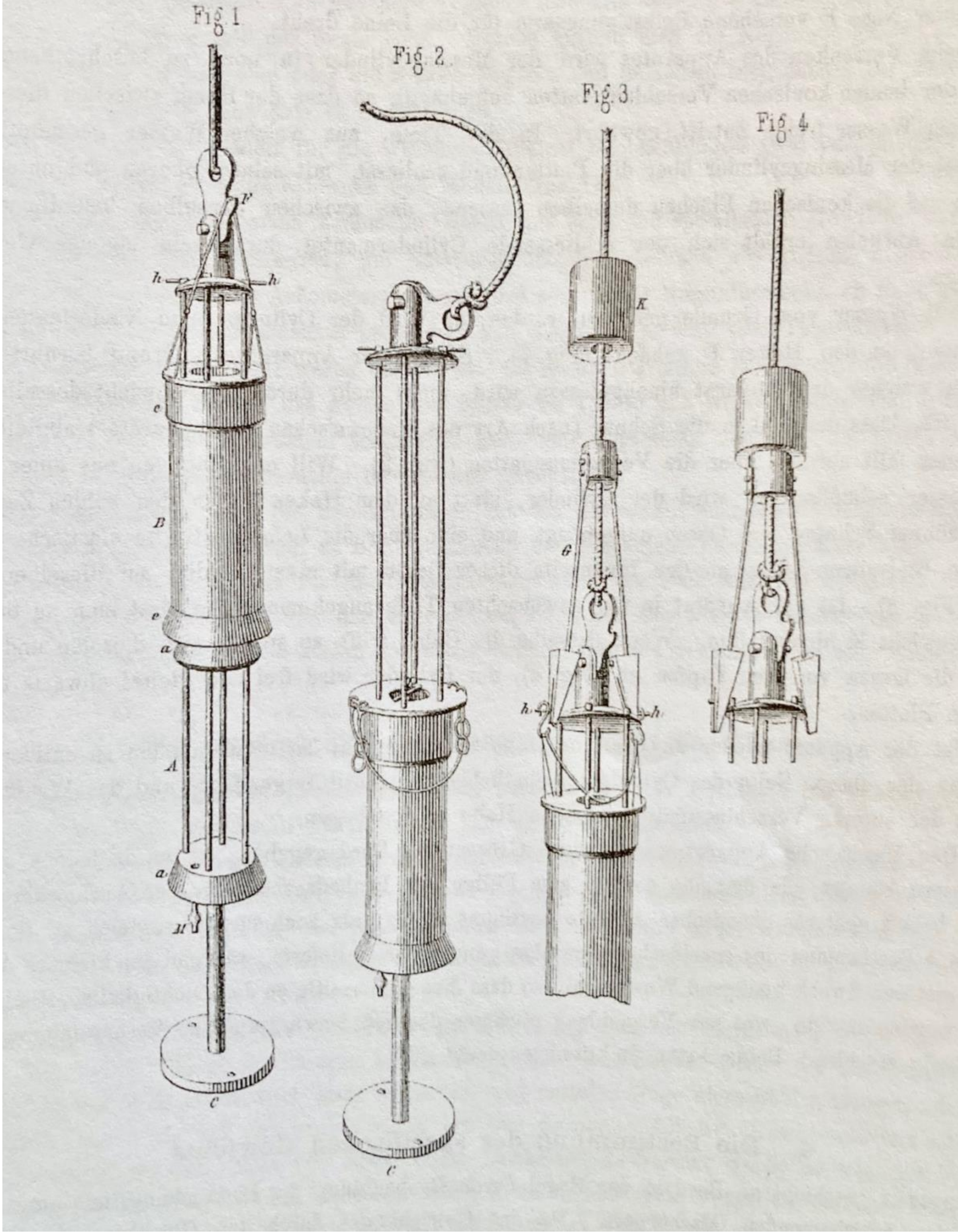
To determine the specific gravity and the chemical composition of the water at different depths, it is necessary to draw water samples from these depths. The apparatus to be used for this purpose must be set up in such a way that the water sample taken at a certain depth is transported to the surface unmixed, and that it does not mix with the water of other layers through which it is brought up.

The simplest device, consisting of a bottle, which is closed with a cork and weighed down with a sounder, is released into the water and uncorked by a release device at a certain depth so that it can then be brought up with water as quickly as possible, is only for use at shallow depths. For greater depths, differently constructed apparatuses are necessary, which in particular guarantee full security for the closure of the sampled water against mixing.

S.M.S. „Gazelle" was equipped with the **MEYER water sampler**, which distinguishes itself from other apparatuses by its simple construction and is particularly practical when water samples are to be taken from the bottom.

It consists of a brass cylinder, which is closed by means of a trigger mechanism at the top and bottom by metal plates with conical edges (Table 3).

Wafserschöpf-Apparat nach Meyer.



1
2

22

The brass cylinder slides up and down on the round rods and is guided by the same. An iron base C consisting of a rod and a plate is screwed under the lower plate in order to prevent the apparatus from bumping into stones or to prevent it from sinking into the mud. A lighter or heavier sounder is attached to this base, depending on the depth to be examined.

The upper end of the round rods is closed by a plate, which carries two horizontally standing small pins h on both sides, and above a fork in which the attachment arm provided with a nose P for the line rotates around a bolt.

If water is to be lifted from the bottom, the cylinder is hung on the hook F by means of a cord when it is lowered (Fig. 1). As soon as the device touches the bottom and the line on which the device is lowered is no longer taut due to the weight of the same, the hook lets the line slip (in the manner of BROOKE's sounding device) and the cylinder falls down over the closing plates (Fig, 2). If, on the other hand, one wants to draw water from another depth, the cylinder, instead of the hook F, is hung on the two pegs h h by means of thin cords and eyelets, and an elastic fork G, which is striped over the line, with its end tips on the inside of the line Eyelets with a slot placed on the same pin (Fig. 3). Once the apparatus has reached the desired depth, a running weight K is allowed to slide down the line. When it hits the fork, it spreads and thereby pushes the eyes off the pin (Fig. 4), the cylinder becomes free and slides downwards over the conical plates.
When the apparatus has reached the surface again, a small air valve L located on the upper side of the cylinder is opened in order to empty it, and the water is drained through a tap M located on the lower closure plate.

MEYER's apparatus was on board in two sizes, but the larger one was mostly used, as it was used both for filling the sample bottles that were used to store water for later chemical analysis as well as for measurements immediately on board

It provided enough water for the determination of the specific gravity, while the smaller apparatus collected enough water only for the former purpose. They were used at the same time since it seemed sensible to check that there was no possible contamination. Both types otherwise worked well.

4. The determination of the specific weight of the sea water

is usually done on board by observing the immersion depth of a floating glass body weighted down below. Since the weight of the water displaced by the glass body is always the same as the weight of the glass body, this method measures the volume of a constant weight of water, which results in the density or the specific weight of the water.

The instruments used for this purpose are called hydrometers or, because of the latter property, volumeters (also called hydrometers in England). They consist of a wide glass cylinder, which gives the instrument the necessary buoyancy to carry the weight necessary for an exactly vertical swimming position, and a thin glass tube above it with the scale for reading. The weight, made of metal grains or mercury, is carried by a glass ball fused under the cylinder. The more precise information you want to get with the instrument, the thinner the glass tube with the scale must be. Hence the necessity of using either very long glass tubes, or of restricting the use of one and the same instrument to very small differences in specific gravity.

S.M.S. ,,Gazelle" received two different types of hydrometers for scientific observations, the STEEGER-KÜCHLER model and the GREINER model.

The STEEGER-KÜCHLER's hydrometers were provided with a specific gravity scale from 1.024 to 1.031; the load on the same consisted of small pellets.

There were two so-called normal sets of GREINER hydrometers on board, which consisted of sets of 11 instruments, 10 of which each reached over three thousand parts and were divided for ten thousand parts in such a way that the scale of the first instrument had the specific weights of 1.0000 to 1.0030, the second from 1.0030 to 1.0060, etc, the last from 1.0270 to 1.0300; the eleventh instrument had a general graduation ranging from 1.00 to 1.03. The filling of the instruments consisted of mercury.

Usually the observations were made with the STEEGER-KÜCHLER instruments, which are present in large numbers on board and for which special correction tables were given, while this was not the case for the GREINER instruments and the details of which deviate slightly from the former. With very low specific weights of the water, however, the latter had to be used because the STEEGER's were not sufficient.

5. Determination of transparency of water

was carried out by means of a simple brass instrument, which was lowered into the water on a sounding line, by determining the depth to which it remained visible.

The instrument consisted of a white-painted, perforated hollow cylinder on which a cone was placed above and below, each of which had a ring for attaching the sounding line and the weight; the cylinder was 30 centimeters high and had a diameter of a little over 20 centimeters, so that the horizontal mean area represented a circle of 340 square centimeters,

As a rule, the investigations were made on the occasion of the sounding when the ship was still. In order to obtain a correct standard for the various degrees of transparency, it seemed necessary that one and the same eye should always make these observations, and therefore they had been assigned to one and the same officer, Sub-lieutenant at sea ZEYE, on the whole voyage. The instrument, weighed down with a sounding lead, was lowered as far into the water as could still be seen with certainty, and this operation was repeated several times, usually on different sides of the ship in order to avoid one-sided lighting. It could be seen to 50 meters.

24

6. Current measurements.

A specially constructed log was used to determine the surface current, and a metal cross was used to measure the deep current.

The log was triangular, 50 centimeters high, had a 60 centimeter baseline and was weighed down enough to float in the water to the point, so that only a flag attached to it protruded above the surface; in this way it should be withdrawn as much as possible from the influences of wind or air resistance, offering the water the greatest possible resistance. The attachment of the log line to the same was like the usual log like a stop-cock(?) with a wooden stopper to pull out. An ordinary log line was used as the line, but usually marked by meters.

The metal cross for measuring the deep current consisted of two rectangular 30 to 40 centimeters long and high which, when in use, stood at right angles to each other, and when not in use, could be folded up. It was sunk to the depth concerned by means of a weight attached to it, and carried by a small buoy to which the cross was attached by means of copper wire.

Line was later used instead of copper wire, as some depth current gauges were lost when the wire broke on the surface just below the buoy, probably as a result of the kink that occurred when it was attached to the buoy. Likewise, after the loss of several sheet metal drogues, canvas drogues were made on board in the same shape and used instead of the former.

The current observations were usually carried out on the occasion of the deep-sea soundings, namely from the vessel. After the sounder was on the bottom, the buoy was attached to the fixed sounding line and determined the surface current by means of the described log. The log line was usually allowed to run for half a minute, but if the current was weak for one to two minutes, in some cases up to five minutes. The direction of the current was determined by the ship's compass.

After the surface current had been ascertained, usually several times, the buoy was detached from the sounding line, and while the latter was being hauled in, the deep current was determined. For this purpose, the depth flow meter and the surface flow meter were allowed to drift at the same time for a certain period of time, the vessel kept to the buoy of the former and determined the direction and distance of the surface flow meter from here after the time had elapsed. From this and from the previously determined and known surface current, the deep current was calculated, assuming that the deep current meter had only followed the current prevailing at the relevant depth. The effect of the surface current on the buoy supporting the sheet metal cross was neglected due to its small size,

The example taken from the Sounding log of S.M.S. "Gazelle" and given on page 17 serves as an explanation. In order to determine the surface current, the log line was exposed from the stationary boat and ran out of it 16.5 meters in 1/2 minute, while the log ship SW1/2S p. C. was sighted. Consequently, the surface current continues in this direction (or true SW 1/2 W, p. C. 11°East magnetic declination), namely (16.5x2x60)/1852 =1.07 nautical miles per hour.

The depth current meter was then sunk to 50 fathoms, the same was set overboard with the logging ship and, after a minute, the target was taken from the buoy of the former to the latter and the distance between the two was determined to be 16 meters. From this and from the surface current that has just been found, one obtains, best by coupling both – i.e. SW1/2S 33 meters per minute and ENE 15 meters -. that the deep curerent was S_z 20°W or S W1/2W 22 meters per minute or$\frac{2x60}{1852}$ = 0.67 nautical miles per hour. The calculation of the current at 100 fathoms is done in the same way.

7. The observation of the water level

A self-registering tide gauge was to be used on the Kerguelen, and a special iron house was provided for the installation. The simple apparatus was constructed as follows. In a standpipe made of zinc that is freely connected to the water, an iron float moves on the surface of the water; the metal chain attached to the same runs over a metal wheel that can rotate on a horizontal axis, the periphery of which is provided with small pegs, and at the other end carries a lead counterweight. That through the movement of the float's reciprocating wheel activates a vertically guided rod and a pen attached to it. The latter slides on a sheet of paper stretched over a roller, which is set in a steady rotating motion with the roller by a good and reliable clockwork, and thus registers the position of the float or the water level on the paper at all times,

8. Trawling equipment.

For fishing animals and plants on the seabed, on the surface and in between, S.M.S. ,,Gazelle" was equipped with trawls or nets of various designs. These were designed for hauling on the bottom; identified by the shape of their opening or the frame surrounding it: elongated, triangular and semicircular nets.

The elongated ones. Tow nets were formed from a rectangular, 800 centimetre long, 250 centimeter wide, iron frame and the approximately 1 metre long net attached to it. The two long sides of the frame were provided with a cutting edge inclined outwards by about 10°. While the net was lying on the bottom with one of the long sides, these blades were supposed to be drawn along the sea bed, penetrate into it like a plough, and allow the soil constituents to slide into the net. On each of the narrow sides of the frame a rotating two-armed iron bracket was attached, by means of which the net was attached to the tow line by a strong sling.

In the triangular nets, the iron frame formed an equilateral triangle 1/2 meter long sides; the 500-600 millimeter long net surrounded a sack made of strong canvas that adjoins its dimensions. All three sides of the frame were provided with cutting edges so that one of them was always on the ground. A three-armed bracket with a ring, the three arms of which were each attached to one corner of the frame, was used to attach it to the towline.

The half-round nets had a semicircular iron frame, the lower straight side of which was about 700 millimeters long and provided with the cutting edge, and to which a 700 millimeter long canvas sack with a surrounding net was sewn. At each end of the lower side of the frame, or the edge, an iron arm of somewhat larger dimension than this was fastened, with which the net lay on the seabed. The attachment to the towline was done by two thick rings attached to the side of the frame.

The elongated trawls were mainly used for hard ground, the triangular ones for stony ground and the semicircular ones for soft ground.

As a rule, a number of bobbins were attached to the nets, usually on horizontal poles attached to the frame, to capture small, delicate marine organisms.

When towing at great depths, the procedure was similar to that for sounding; The net was lowered to the bottom of the sea from the stationary or drifting ship with a line of the same strength as the sounding line, using the accumulator, and the line was paid out one and a half or two times the depth of the water.

So that when the ship is slowly drifting, the net can hit the seabed as horizontally as possible. and was not lifted by the pull of the ship, acting more or less obliquely downwards, a heavy plumb bob or weight was attached to the towline at some distance (400-600 meters) from the net. When the current was strong or the ship was moving over long distances, the line was weighed down with plumb bobs at various points.

For fishing in shallower water depths and on the surface, lighter tow lines made of thin material and attached to a circular wooden hoop were used; the diameter of the latter and the length of the sack were about 1/2 meter. The wooden frame was weighted with lead on one side so that it floated vertically in the water. For use, these nets were attached to the tow line with three rings attached to the frame and was pulled horizontally through the water with the opening to the front.

These nets or sacks were also used from the boat, as well as the basic nets on shallow water.

For hand use, for fishing on the surface, both from the boat and from the ship, light duty nets with handles in the style of butterfly nets were used.

9. Meteorological observations.

The meteorological observations covering air pressure, temperature, moisture content of the air, precipitation, wind direction and strength, the appearance of the sky and cloud formations were made on board during the entire voyage by a specific officer on each watch, and on Kerguelen Island by a shore based commanding officer at regular time intervals (1 to 4 hours). For the same the following instruments were given on board:

a) 1 normal barometer from GREINER & GEISSLER, Berlin.
b) 1 registering barometer from SCHADEWELL, Dresden.
c) 6 good thermometers from GREINER & GEISSLER.
d) 6 portable thermometers from GREINER & GEISSLER.
e) 8 maximum and minimum thermometers and a device for exposure for longer periods of time of GREINER & GEISSLER.
f) 2 psychrometers from GREINER & GEISSLER.
g) 1 REGNAULT's hygrometer with aspirator from GREINER & GEISSLER,
h) 1 hair hygrometer from GREINER & GEISSLER.

i) 1 rain gauge from GREINER & GEISSLER,

k) 1 ship rain gauge in gimballed suspension from GREINER & GEISSLER,

1) 1 ship anemometer for manual use by KRAFT in Vienna (was only used after Mauritius).

m) 1 registering anemometer according to BECKLEY von CASELLA, London.

n) 1 gimbal-mounted wind vane from KRUGER in Berlin,

o) 1 ozonometer from KLEBS & KROLL, Berlin, along with a box for the exhibition.

10. Magnetic Observations.

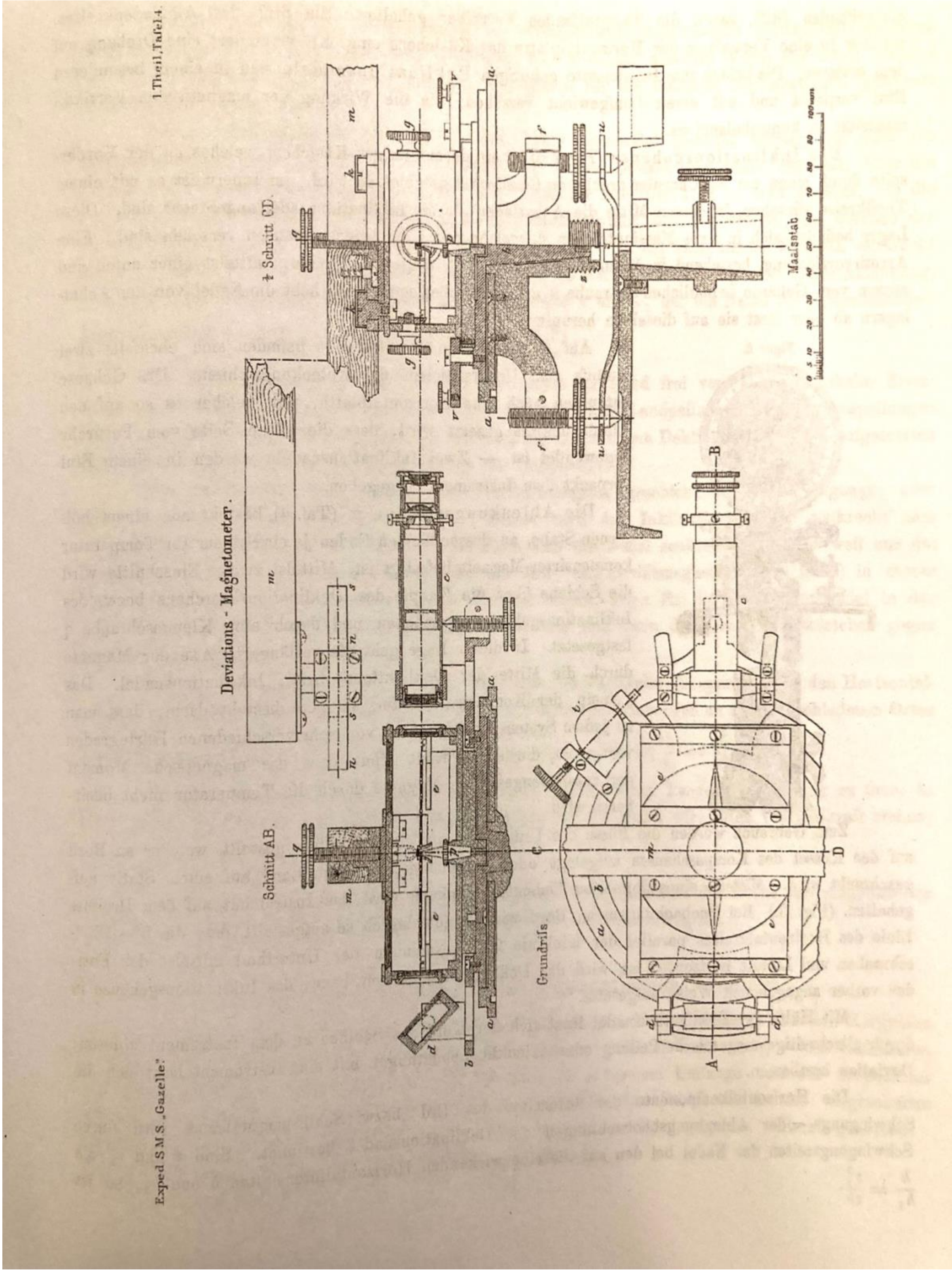
The purpose of the magnetic observations was not only to establish the magnetic character of the ship, its changes and its influence on the compass needle, which is necessary for navigation, but also to determine the geomagnetic elements and their variations. For the latter purpose, the ship was given a set of LAMONT magnetic variation instruments from KARL in Munich, which were only used during the longer stay on Kerguelen Island. The other magnetic observations were carried out on board and on land during the whole voyage with the aid of a Fox apparatus and a deviation magnetometer (after NEUMAYER by C. BAMBERG).

Since the Fox Apparatus and the Variation Instruments are described in more detail in the account of the magnetic observations in the second part of this work, so only the deviation magnetometer will be briefly described here,

The Deviation Magnetometer. The same is used for the relative determination of the horizontal and vertical components of the intensity of the earth's magnetism and the combined earth and ship magnetism acting on the compass needle on board and can also be used for various other magnetic measurements such as declination, inclination and deviation.

The instrument consists of the following four main parts: the lower part, the declination box and the inclination housing, the latter two with the associated needles, and the deflection certificates. The lower part ordered from a horizontal round metal plate. which rests on three feet and by means of screws f f (plate 4) attached to the latter which can be levelled with the aid of a circular level. The plate bears a horizontal circle a divided into degrees, and within it the alidad circle b, which can be rotated about an axis, with a vernier and a micrometer mechanism for setting. On the edge of the alidad circle rests with its front end in the bearings of a carrier and with its centre on a screw, the telescope c, opposite to it there is a bearing d for a mirror for the bearing of celestial bodies. In order to clamp the declination box and the inclination housing, which have been put on in a hurry, the alidad circle has a quarter turn v v on each, which are turned over the edge of the housing.

The declination box is a square box with a glass lid, which can be screwed on both sides with two screws. In the middle of the box and in the center of the ivory graduation e e attached to both sides is the tiller for the declination needle. The zero points of the scales are marked by small vertical tips. The side walls of the box contain small round glass windows for closer observation. Two buttons attached to the lid to slide open the deflection rail. The little declination box is placed with one and its underside on the horizontal plate on the alidad circle and held by a pin engaging in a recess in the latter, as well as the overlapping sash.


Exped S.M.S. „Gazelle“
I.Theil, Tafel 4.
Deviations - Magnetometer.
Schnitt AB.
½ Schnitt CD.
Grundriss
Maassstab

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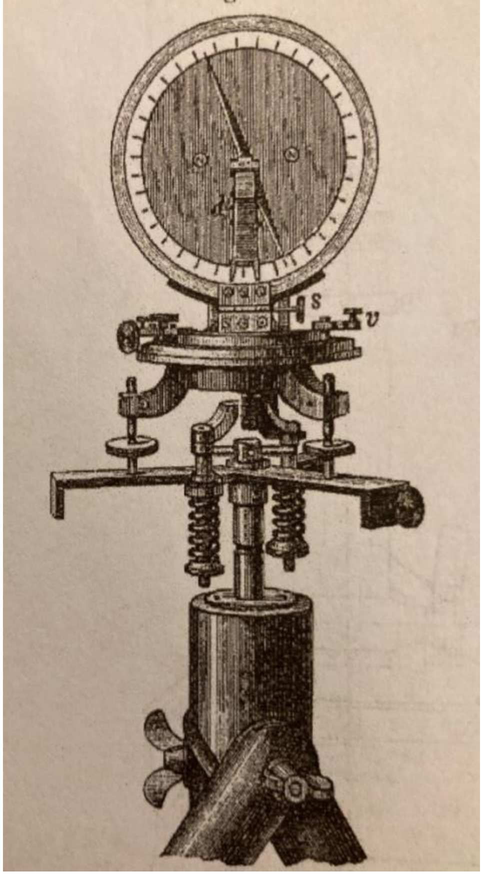
2

A pin of the alidad cross, which engages in a recess in the horizontal plate of the box, prevents rotation on the former. The two declination needles belonging to the instrument are packed in a special case and provided with a barrel weight to counterbalance the effect of the magnetic vertical intensity.

The inclination housing (FIG. 6) is a box-shaped box which is closed at the front by a glass lid that can be rotated around a hinge. Inside it is provided with a partial circle, in the middle of which the agate bearings for the inclination needle are attached. These bearings are located in two brass supports d, which are provided with correction screws. A locking device, consisting of brass bearings, which can be moved up and down along the carrier by means of a screw s located below and on the outside of the housing, lifts the needle from the agate bearings or leaves them. down on the same.

There are also two on the back of the case

Figur 6.



Buttons to slide the deflection rail over. The housing also has a horizontal plate at the bottom, with which it is placed on the circle of the alidad in such a way that the open side is turned away from the telescope. - Two inclination needles are packed in a case and added to the instrument.

The steering rail m (Plate 4) consists of a wooden rod, at both ends of which a system for temperature-compensated magnets is attached. In the middle of two incisions, the splint is attached via the buttons on the declination box. of the inclination housing and fixed by a clamping screw q. In this position the extended axis of the magnets goes through the center of the declination, respectively. Inclination needle. The principle of the compensation of the magnets consists in using two magnets of very different degrees of hardness for each system, which are chosen so that the magnetic moment of the assembled magnets is not influenced by the temperature.

For use, the feet of the lower part are placed on a tripod, which is placed or hung on the vessel of the compass house on board, or screwed onto a tripod on land. The instrument is held on the tripod by means of a double spring bar hook. (Fig. G.) When observing on board, it is usually set up so that the 0 ° -180 ° line of the horizontal circle falls parallel to the keel line. After the lower part has been leveled by means of the foot screws and level, the declination box or put the inclination housing on in the manner indicated above.

With the help of the declination needle, the course of the ship can be read on the instrument; the deviation can be determined by simultaneous magnetic bearing or azimuth observations with the instrument.

The horizontal component of the intensity of the earth, respectively. Ship magnetism is determined by observing vibration or deflection of the declination needle.

If t and t_1 are the oscillation times of the needle at the horizontal intensities h and h_1 acting on it, then

$$\frac{h}{h_1} = \frac{t_1^2}{t^2}$$

According to this, the ratio of two different magnetic horizontal intensities can be determined by vibrations of the horizontal needle, and if the absolute value of one is known, that of the other also results, although more precise methods deserve preference for the latter determinations.

If perturbation observations are to be made with the declination needle, the deflection bar is pushed over the buttons of the declination box after the needle has moved between the two tips of the scale, and the alidid circle is then rotated until the now deflected needle coincides with the same marks again, and the angle at which the circle is rotated, equal to the deflection angle φ, read off. Since the deflecting magnets are directed perpendicular to the center of the deflected needle, the deflection is a sinus deflection; H. are the corresponding ones under the action of different horizontal forces φ and φ_1 on the needle so that

$$\frac{h}{h_1} = \frac{sin\,\varphi_1}{sin\;\varphi}$$

To determine the declination, the instrument is set up on land free from the influence of local iron masses, and the geographic meridian is determined according to either land bearings or celestial bearings. The deviation of the declination needle attached with the declination box from this direction gives the declination.

The determination of the magnetic vertical intensity is done by observing the vibration or deflection of the vertical needle. For this purpose, the inclination housing is set up perpendicular to the magnetic meridian, in which case the needle adjusts itself vertically, because only the vertical component of the earth's magnetism (or the earth and ship magnetism on board) can act on it in this position. This is best achieved if the alidic circle for the declination needle was previously clamped in the zero position and then the declination box is exchanged for the inclination housing. From the vibration observations one finds the vertical forces quite analogous to the horizontal forces; z and z_1 are the vertical forces, under the influence of which vibrations in two different places are observed, t and t_1 the associated oscillation times, then

$$\frac{t}{t_1} = \frac{z_1^2}{z^2}$$

During the perturbation observations. one is dealing here with a tangent deflection, since the deflecting magnets of the rail are perpendicular to the vertical force acting on the needle;

so it is $\quad \frac{z}{z_1} = \frac{tang\;\varphi_1}{tang\;\varphi}$

To determine the inclination, the inclination housing is placed in the plane of the magnetic meridian, in which position the needle directly indicates the inclination.

11. The astronomical and geodetic works

stretched. in addition to participating in the observations of the passage of Venus on the Kerguelen, primarily on the determination of geographical positions and on measurements and recordings of islands, harbors and coastal stretches. In order to be able to carry out the same on a larger scale and with the greatest possible accuracy, a number of the necessary apparatus were put on board in addition to the instruments already provided for in the ship's budget. These included:

1 ten-inch prism circle from PISTOR & MARTINS,

1 six inch do. do.,

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5 chronometers (apart from the 3 regular marine chronometers),

1 artificial horizon from PISTOR & MARTINS,

1 artificial horizon, iron trough, from BAMBERG, Berlin,

Measuring rods and tape measures from BAMBERG;

1 binocular glass from S. Merz., Munich,

1 revision pendulum with comparator and corresponding setup according to NEUMAYER, from BAMBERG, Berlin,

2 Heliotrope from STEINHEIL, Munich,

1 travel barometer according to FORTIN, by GREINER & GEISSTLER,

1 normal hypsometer from GREINER & GEISSLER.

Chapter III

Sailing rules and scientific instructions.

(In excerpt).

First sailing order.

At Berlin, June 8, 1874.

The Royal Sea Captain and Commander S.M.S. "Gazelle"; his excellency Baron VON SCHLEINITZ:

Your honour, herewith the sailing order for S.M.S. Gazelle with the instruction to start the voyage as soon as the fitting out of the ship has been completed and the station chief has inspected it.

By the highest cabinet order of March 10th this year S.M.S. ,,Gazelle” is commissioned for scientific purposes, and the corvette has been given special equipment for this purpose. In order to gain space the guns have been reduced to eight and the crew has been reduced. Nevertheless, S.M.S. ,,Gazelle’ must retain the character of a warship and I expect that, Your Excellency, the conventions of managing the ship will always be maintained, even under the given circumstances.

The main task for which S.M.S. ,,Gazelle’ has been equipped is the transport and support of the astronomical expedition, which is supposed to observe the passage of Venus in front of the sun on the Kerguelen Islands.

For this purpose, your intentions have to take into account the wishes of the leader of the said expedition, Dr BORGEN) as much as possible, and to support the work of the expedition with the means of the corvette as far as possible.

It embarks with its material in Kiel on board the ,,Gazelle" and is then to be transported to the Kerguelen and from there to Mauritius; the return journey from here takes place by mail ship.

I recommend that you and the officers participate in and contribute to the scientific work of the scholars, so that after the latter have disembarked, we can be of benefit to science.
You will receive a copy of the instruction received from the observation expedition for your information. Your Excellency will receive special instructions about the other scientific purposes to be pursued on the S.M.S. ,,Gazelle" trip.

On the subject of the itinerary you will receive the following order:
On October 20th. S.M.S. ,,Gazelle" must be in the Accessible Bay on the Kerguelen in order to enable the landing of the expedition and its apparatus, so that the systematic astronomical work on the Kerguelen can begin at the beginning of November. This appointment must be carried out under all circumstances.

After leaving Kiel, after the coal has been replenished in Plymouth if necessary, you have to choose a course so that it starts from the latitude of the Azores almost halfway between the course of the English ship ,,Challenger" and the European-African coast, then to pass Madeira and the Canary Islands in the west and, if necessary call at the Cape Verde Islands to refill coal.

From here you steer to Monrovia (Liberia) and show the flag there for a few days in order to comply with repeated wishes of the Germans living there to see a German warship there.
You then have to steer a southerly course and cross the equator at about 14 ° west longitude.

From the equator you have to steer true south to latitude 20 ° south. The instructions contain details about the soundings to be carried out along this course.

From here (20 ° south latitude and 14 ° west longitude) you have to set your course towards the confluence of the Congo and go to the Loanda coast, where it will be possible to replenish the coal in Banana.
Assuming that you leave Kiel around June 20th, you will reach the Atlantic Ocean at the beginning of July and cross the line calling at Monrovia at the beginning of August. By mid-August the ,,Gazelle" can reach the point 20 ° south latitude and 14 ° east longitude and, if you do not find the tradewinds unfavorable, you can be in Banana towards the end of August or beginning of September. The stay in Banana should be restricted as far as possible, because although August and September are still favorable months for the state of health in Lower Guinea, you have to reach Cape Town by September 20th at the latest.
You will find the German expedition to explore Central Africa on the Loanda coast. The appearance of the ,,Gazelle" there will increase the reputation of the expedition among the population and can be of advantage for their work. A further purpose should by no means be connected with the visit to this coast, and your Excellency must avoid any demonstration which could give the inhabitants the impression that you are pursuing political aims.
After you, if time permits, have carried out the scientific work on the Loanda coast, which are described in more detail in the special instructions, you have to continue your journey to the Cape of Good Hope, in a detour so that you cross the Greenwich Meridian at about 30 degrees south latitude.

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If the journey in the Atlantic Ocean should be delayed against the plans due to unforeseeable circumstances, you have to head for Cape Town by the shortest route in order to be able to leave for the Kerguelen in good time.

At the Cape of Good Hope, where there are observatories for astronomical and physical purposes, there is an excellent opportunity to verify the various instruments again and to carry out control observations with them. You must therefore ensure that this opportunity is used in the most extensive manner by officers and scholars, and I would especially like to draw your Excellency's attention to the fact that particular care must be taken here with regard to the chronometer regulations.

After leaving the Cape, first head south to about 39 ° south latitude and then to the Crozet Islands in order to compare the American observation expedition stationed on these islands with the Cape on the one hand, and with the various expeditions stationed on the Kerguelen on the other. However, the arrival at the Crozets should not involve any stay and you should not land if this makes the landing on the Kerguelen at the above-mentioned time (October 20th) impossible.

During the unloading and landing of the scientific expedition on the Kerguelen, you have to ensure that this work is made as easy as possible by the crew and boats, and that the erection and furnishing of the observatories and huts is carried out by the carpenters of the ,,Gazelle".

If the circumstances permit, your Excellency, two officers from S.M.S. ,,Gazelle”, should take part in the scientific observations on Kerguelen and you should instruct them to follow the instructions of Dr BÖRGEN in all scientific work. They are to be disembarked with the expedition and must remain on land for the duration of this work. A suitable room for the accommodation of these two officers will also be prepared in the living rooms of the expeditionary force.

With regard to the observation rooms for the purposes of the navy, the tide house and anemometer, the meteorological hut and the hut for the magnetic variation instruments, the construction of which must be started immediately after landing, the instructions will contain more details.

Before dismantling the observatories later, you must satisfy yourself that the observations by the officers entrusted with them were carried out in accordance with the instructions, and that the instruments are in working condition.

From November 1st to the time of the transit on 8th / 9th December you have to take care to promote the scientific work of the expedition in every possible way. The most practical way to do this is that S.M.S. ,,Gazelle" undertakes chronometer intercomparisons with the individual stations on Kerguelen, as well as making the ship’s chronometers available on land at the time of the transit.

After 8./9. December there are two possibilities:

The observation of the Venus transitory succeeded,

It did not succeed due to the atmospheric conditions.

As a result, your Excellency you should follow these instructions:

1) In the first case, as soon as possible after December 9th, send SMS ,,Gazelle" to the main route of the Australian shipping (between 40 and 43 degrees south latitude) and try to send a signal to a merchant ship that the observation has succeeded, with the request that the consul telegraph the message here. In the best case, the news of the success of the observation can be here as early as the first half of January 1875.
If there is enough time left afterwards, as long as the expedition remains on Kerguelen after the passage, a scientific trip to the south by S.M.S. ,,Gazelle" could be undertaken. The instruction mentioned at the beginning will specify the task and purpose of the same. Although this trip to the south is quite desirable in the scientific interest, I expressly note that I leave it entirely to the discretion of your Excellency to undertake it in whole, in part or not at all, depending on whether you find the weather conditions and the condition of the ship suitable.
S.M.S. ,,Gazelle" must have returned to Accessible-Bay (Kerguelen) by January 25th and be there ready for the re-boarding of the astronomical expedition and its apparatus. You want to agree the time of embarkation and loading with the leader of the astronomical expedition, Dr BORGEN, and take the items brought from Europe back on board as far as it is deemed necessary.
The expedition is then to be taken to Mauritius and disembarked there with its equipment. However, that part of the equipment whose further transport by ,,Gazelle" is particularly desired must be kept on board.

2) In the second case, if the observation is unsuccessful, the discussed trip to the south must in any case not be made, and so on,
In both cases, the passage may or may not have been observed, it might be desirable for the expedition, after leaving the Kerguelen, to revisit the station of the Americans and English, which is why your Excellency will do as much as possible to comply with the wishes of the astronomical director; The same applies with regard to the calls to St. Paul and Amsterdam Islands.
On your trip to Mauritius, you will have to take into account that at the time when it is taking place, the Mauritius hurricanes are very frequent. In Mauritius, where even the corvette, if the observation succeeds, at the end of February or the beginning of March, if the observation does not succeed but can arrive at the end of December or the beginning of January, Your Excellency will find detailed instructions for the further voyage.
For the time being, therefore, you will only be informed that S. M S. "Gazelle" should have returned to Europe by late autumn 1875 and that the return journey should take place through the South Seas and around Cape Horn, possibly north around Australia, through the Torres Strait and calling at the Samoa Islands, the Fiji Islands and New Zealand through the Strait of Magellan.
For the time being, I have arranged for the letters for ,,Gazelle" to be sent to Mauritius so that you will receive the next letters in Cape Town after leaving Kiel. You will receive the last post there on the mail steamer coming from Dartmouth about September 23rd. After this time the letters for Gazelle will be sent to Port Louis (Mauritius).
With the instructions for the further journey that arrive there, your Excellency will receive notification of the further instructions relating to the letters for ,,Gazelle". Head of the Admiralty VON STOSCH

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Scientific instruction.

Berlin, 16 JULY 1874

To the Royal Captain of the Sea and Commander S.M.S. "Gazelle", his Excellency Baron VON SCHLEINITZ, Kiel.

For your attention, your honorable wishes are attached to the instructions submitted to me by Professor Dr NEUMEYER for the scientific work to be carried out during the voyage of the corvette under your command. In a certain sense, these form a supplement to the instructions issued by the Reich Commission for the Organization of the Observation of the Venus Passage, a copy of which was sent with the sailing order.

The present instructions are initially only calculated for the journey to Mauritius, and your Excellency, when you arrive at that port, you can look forward to extensions and additions to the same.

While I uphold the arrangements made in the general sailing order in all respects, this instruction has the special purpose of standardizing the scientific work, provided that it is not purely astronomical in nature, and your Excellency is requested accordingly to the stipulations contained in them to ensure the most precise attention on the part of all parties involved.

The Chief of the Admiralty. Signed VON STOSCH.

§ 1. Since on the one hand in the general sailing order of 8th d. Mts. the main features of the routes that SM Corvette has to take, in addition to the scientific work with reference to the passage of Venus, have already been determined in accordance with the wishes of the executive committee of the commission appointed by the Reich Chancellor, on the other hand the special instructions that this commission has issued, order everything necessary in this direction, or request that it be arranged, the current instructions can be limited to establishing the standards for physical and hydrographic work both during the voyage and at sea, as well as during the duration of the stay in Kerguelen.

§ 2. The physical and hydrographic works fall into two main groups
Work at sea and while traveling;
Work on Kerguelen, namely in Accessible-Bay, where the German expedition to observe the Venus transit will be set up.
§ 2. a) The work at sea and during the voyage are:
Geographical location determinations as the foundation and fundamental requirement of all other work.

Systematic meteorological observations. Magnetic observations.

4. Oceanographic observations of ocean currents and wave motion and etc..
5. Deep sea explorations and deep sea soundings.

Wherever it seemed desirable, all the necessary guidance is laid down in special instructions 1), to which reference is hereby made, as well as a study of the relevant literature carried aboard S.M.S. Gazelle.

§ 4, Ad 1. Particular care should be taken with position finding at sea. These are not only the most important observations necessary for location and defining the route taken, but also the combinations of the various methods of latitude and longitude determination, the position of the ship as often as possible during a day and at closely spaced intervals so as to be able to make comparisons. This increases the value of the scientific work itself, but only through this can the method of determining the location be further developed.
Special care is to be devoted to the chronometers and their scientific treatment. To promote this branch of navigation, it is essential that distance determinations be maintained independently of chronometers. In addition to frequent observations of lunar distances, investigations are also to be carried out on the possibility of successfully using star sights, the eclipses of Jupiter's moon, etc. for the purpose of deriving the geographical longitude, and this is then to be reported. Examination of the usefulness of the various nautical instruments required for location determination and investigations into the degree of accuracy of the results to be achieved with the individual instruments and under certain conditions.

§ 5. Ad 2, The systematic meteorological observations must begin on the day on which the corvette leaves Kiel and are to be continued without interruption until the return to this port.
The organization of the system can be seen from the printed forms for the observations, which were used for this voyage instead of the meteorological forms previously used in the Imperial Navy, and therefore no special instruction is required. It is also not necessary to discuss the methods of observation in more detail here, since everything that is required and related to this is contained in the special instructions.
The observations must be carried out strictly in accordance with these instructions and entered in the forms provided on board. Entries must be made immediately after the observation so that the meteorological journal is always kept up to date, and this entry must be made by the observer himself.

Particular attention must be paid to the psychrometer observations and the simultaneous determination of the moisture content of the air by means of a hygrometer. It is necessary that care is always exercised, that the observations are calculated from time to time and the results are checked thoroughly during the journey, so that any errors in the methods of the individual observers can be discovered and errors can be corrected. Observations of this kind have more of the character of an experiment, and must therefore be properly practiced by the individual observer before one can expect absolutely reliable results.

§ 6, Ad 3, Magnetic observations at sea,
The magnetic observations on board are carried out with Fox's apparatus and with the normal compass, whenever wind, weather and sea permit. It is important to ensure that the three elements; declination, inclination and intensity are determined whenever possible.

1) The inclusion of special instructions has been omitted from here because of their large scope.

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The gymballed table on which the Fox apparatus is placed during the observation, must always remain in the same place and it must be strictly observed when a change in the arrangement of the ferrous items takes place in its vicinity. Should such a change become inevitable, this must be noted in the journals.

The observations are entered in the forms intended for this purpose, and the persons entrusted with the same must exercise every precaution so that they are iron-free themselves, which, incidentally, should also be checked after each series of measurements is carried out.

The determination of the coefficients necessary for the reduction of the observations must be carried out with the greatest care whenever the opportunity arises.

It is very desirable that the values of the magnetic elements be carried out on land, when the opportunity arises, with the same instruments that are used at sea. The Cape of Good Hope and Mauritius are particularly recommended for this, as there are magnetic observatories at both locations, which enable the instruments to be strictly controlled.

Observing on land, pay special attention to the rocks and avoid volcanic and ferrous formations.

From the observations carried out, some series must always be calculated, partly because of the control of the instruments and to test the methods, but partly also to be able to form an immediate judgment about the reliability of the individual observers.

The numbers of the roses, needles and deflectors that have been used must be strictly stated in all individual observation series.

§ 7. Ac1 4. Oceanographic observations of ocean currents and wave movements, etc., The special instructions contain all the information required for observation, and therefore only a few brief remarks are required here.

To derive the surface currents from a comparison of the drift [Dead-reckoning?] and the astronomically determined positions of the ship, it is necessary

1. that this comparison can take place in shorter periods of time (than a day);
2. that the (magnetic) deviation is precisely known and can be taken into account;
3. that careful attention is paid to driving and steering (i.e. strict comparison of the steering compass with the normal compass).

If the surface current thus obtained can be checked by direct measurement of it, this should be done. For such purposes only observations made in a boat anchored on the sounding line are of value. How often they should be carried out cannot be determined, since the possibility of doing this depends all too much on the conditions, on the areas in which S.M.S. "Gazelle" is located.

Hydrometer examinations and temperature determinations must and can be carried out in a systematic manner. On the surface, the same are to be carried out at the times indicated for meteorological observations; particularly precise control observations must be made as often as circumstances permit, taking into account the specific gravity of the seawater.

If ice is suspected, or if S.M.S. "Gazelle" is near icebergs, frequent and precise determinations of salinity and temperature must be made.

All influencing circumstances are to be stated, such as the distance and direction of the ice masses from the ship, size and horizontal extent of the same etc..

§. Ad 5. Deep sea research and deep sea sounding.

Wherever it is desirable, because of observations that have not yet been exhibited and because of gaps in the knowledge of the structure of the seabed, or because of the opportunity for calibrations, deep-sounding should be carried out, whenever the circumstances permit. The most recent work by H. M. S. "Challenger" in the North and South Atlantic Oceans gives clues for deciding the importance of the positions with regard to these observations. There is a copy of the report on this work up to the Cape of Good Hope on board SMS "Gazelle", from which the main sounding positions can be taken, and since comparison observations relating to the earlier American work are also included in this report, so it offers the clues for the decision of the expediency of the observation for certain stretches.

The English deep-sea apparatus as provided for the work of the S.M.S. "Gazelle" voyage are to be used in the systematic work, i.e. as the rule for deep-sea sounding for research. A list of this and a description is in the hands of the command, while on the other hand, hints for use have been included in the special instructions.

In this chapter of deep-sea explorations (since temperature and current observations are discussed in the special instructions - the literature on board also gives all information about them), only the fauna and flora examinations need to be considered.

The dredging and retrieval of the objects obtained in this way has to be carried out extensively during the journey. Those who have been entrusted with work of this kind are carefully responsible for keeping the samples and ensure that this is done in accordance with the requirements of science. The assistant doctor, Dr HUSKER, is concerned with the zoological work in which Dr STUDER, one of the scholars of the expedition, who as assistant and docent has considerable experience in these branches of science at his disposal, assisted him with advice and practical help which he agreed to do. Stabsarz DR NAUMANN will devote himself to botanical studies and to collecting and storing objects belonging here.

§ 9. b) Working on Kerguelen.

1. Meteorological observations.
2. Magnetic observations,
3. Observations on high tide and ebb.
4. Observations of phenomena in the sky,
5. Pendulum observations.

§ 10, Ad 1. Care must be taken to ensure that the systematic recording of meteorological phenomena can begin on the first of November of this year and is continued without interruption until the expedition leaves Kerguelen.

When the work is finished, i.e. when the observation huts are dismantled and the instruments are packed, only the meteorological station is to be left in its place. All instruments should be removed from it, with the exception of a minimum and a maximum thermometer, the indices of which must be precisely set.

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The letters “S.M.S. "Gazelle" “and the date of the discontinuation of the indices are to be written on the roof of the stand, about which an entry must be made in the meteorological journals.

§ 11. Ad 2. The installation of the variation apparatus for the recording of magnetic observations must be finished on November 1st, so that these recordings can begin on this day in a systematic way.

They will continue, uninterrupted until the observatory is terminated, according to the standards given in the forms for these observations. The special instructions state everything that is required, also with regard to the determination of the values, the division and the zero points of the scales, etc.

§ 12. Ad 3. The tide hut and the equipment for the anemometer must be in order on November 1st, the recordings have to start on this day and are to be kept in order until the end of the stay, so that the records are made regularly.

As stated in the special instructions, the greatest care must be devoted to these instruments, as well as to the recording barometer, so that they come into working order and remain intact. This will require constant attention from the staff.

When the tide hut is demolished, one of the posts on which there is a level mark (bench mark) has to be left standing, and on the other hand all care must be taken to ensure that the level markers mentioned in the special instructions can be found again.

§ 13. Ad 4. With the beginning of the systematic work in meteorology and magnetism, observations about southern lights, zodiacal light and so on must also be started. With this in mind, special reference is made to the work of Professor WEISS, a copy of which is on board, and the instructions given there apply as the norm for the observation of these phenomena, among which only the shooting stars and meteors are specifically mentioned.

§ 14. Ad 5. When the work named sub 1 to 4 has been organized and the setting up of the astronomical observation rooms has been completed, the installation of the pendulum apparatus should begin.

Nothing can already be arranged with certainty about the location of the installation, since the choice depends on the arrangement of the astronomical rooms. If possible, the temperature fluctuations should be kept to a minimum in the space provided for observing the length of the simple seconds pendulum. The room is also designed in such a way that observations cannot be impaired by walking back and forth too often.

First of all, a series of preliminary tests must be carried out with this apparatus so that, on the one hand, one assures oneself of the efficiency of the installation and construction, and on the other hand, the observer can acquire the necessary practice. Once this is done, the real work has to begin.

Before the time of the passage of Venus, a series of pendulum observations are to be made, in which all the different positions and positions of the weights and knife edges are taken into account.

The special instructions to be expected at the Cape of Good Hope will provide all the necessary information.

If the passage of Venus can be observed, a second series of complete pendulum observations must be carried out at the beginning of 1875. When leaving the station, the device is to be carefully removed and well packed. The height of the pendulum, preferably the bearing on which the discs swing, above the level mark must be precisely determined.

§ 15. All apparatus that were used during the observations on land will be packed in the best possible way when leaving the island of Kerguelen, and the individual boxes must be sealed again.

§ 16. The instructions drawn up by the commission apply to the officers' participation in the astronomical work, in particular insofar as these relate to the determination of longitude by means of chronometer transmissions. The same is especially true of the officers' participation in observing the passage of Venus; however, whatever participation is desired on the part of the Imperial Admiralty, the systematic work mentioned in Sections 9 to 14 must not be hindered or even interrupted.

§ 17. Concerning the route for the journey S.M.S. "Gazelle" and highlighting individual points.
In the general sailing order for S.M.S. "Gazelle" the route which it has to follow has been established, as well as the named points which are to be approached along it.
In order to understand the scientific questions that can be raised in the various seas by the work of S. M. S. "Gazelle", a study of the relevant literature is urgently required; the most important points will emerge from this by themselves. Only the following important tasks are pointed out here:

1. The currents in the Gulf of Guinea - their limits and characteristics must be carefully examined and, if possible, ascertained.
2. The phenomenon of the thickness of the air over the west coast of the African continent deserves special attention.
3. The mighty swell (Kalema), which is strongest precisely in the season when the corvette visits the coast, can be observed and determined how far it is related to the prevailing winds, the configuration of that part of the South Atlantic Ocean, or perhaps with tides
4. In the mouth of the Congo, during the stay of S.M.S. "Gazelle" in the roadstead and during a visit on land, particular attention should be paid to:
    a) a point on that coast which is easy to identify, to determine its latitude well, so that the German African expedition, which is present there and is busy exploring Central Africa on the basis of the investigations on the Loango coast to connect their measurements to the same.
    b) The values of the magnetic elements are to be determined by S.M.S. "Gazelle" with the means at their disposal.
    c) If it is possible, opportunities should be taken to compare the instruments of the expedition with those of the S.M.S. "Gazelle".

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5. When approaching the Cape of Good Hope, there are currents to the west of this, and in particular temperature determinations at the surface and in the depths are of importance. (Agulhas current.)
6 At the Cape the instruments are to be compared with those of the observatory there.
7. On the voyage from the Cape to Kerguelen, the Crozet Islands must be approached, which generally gives the course for this route. Particular attention must be paid to the ice conditions - namely between 20 ° and 40 ° E.
8. The oscillations of the water have to be observed on that stretch and numerous measurements taken.
9. The bank or ridge in the ocean, which according to the latest investigations of the "Challenger" apparently connects the Kerguelen and MacDonald Islands, should be examined more closely, particularly temperature conditions and currents.
10. Is it possible to detect a difference in temperature or a certain direction of movement of the water in that area or not at the surface or in the depth?
11. Should, if the observation of the passage of Venus succeeds and the commander S.M.S. "Gazelle" considers the trip to higher southern latitudes to be advisable, the survey of the MacDonald group should be completed - namely in the southeast of the same. It would also be desirable to obtain real measurements from the elevations of the same.
12. In the case that S.M.S. "Gazelle" undertakes the journey to the Antarctic Circle under the Meridian of Kerguelen, attention should be paid to:

  a) What are the current conditions and the temperature at the surface and in the depth along this route?
  b) Where are the first icebergs and where are the first pack ice?
  c) Are whales numerous in that region, and which species of them shows them particularly?
  d) Which are the prevailing winds, and can a line be drawn between westerly and predominantly easterly winds?

The course is to be taken in such a way that SMS, "Gazelle" does not occupy similar positions to those of the "Challenger”, namely in the pack ice near the presumed termination land, but rather in the vicinity of Enderby's or Kemp's-Land can advance.
Under all circumstances, however, the S.M.S. "Gazelle" command must ensure that the ship does not get caught in pack ice or even get trapped in it, even if only for a while.

§ 18. For the journey of S.M.S. "Gazelle" from Mauritius, to which it will go on the shortest route from Kerguelen with the re-embarked astronomical expedition, through the Indian Ocean and the Arafura Sea, further instructions will be sent to the command.

Second sailing orders,

At the Royal Captain of the Sea Commander S.M.S. Gazelle,

Berlin, November 13th, 1874,

Further to the first sailing order of June 8th this year, herewith are the orders for the further use of your Excellency's S. M. S. "Gazelle":

The following sailing order extends as far as Auckland in New Zealand, where I expect the arrival of SMS "Gazelle" at the beginning of October 1875. In Auckland, your honor will be given extended orders about possible calls to the Fiji and Samoa Islands and for the return journey of the ship by the Pacific and the Strait of Magellan.

Assuming that the observation of the passage of Venus was successful, S.M.S. "Gazelle" will reach Mauritius towards the end of February or beginning of March and find this order there. Since this stay falls in the hurricane season, you do should not stay in Mauritius longer than is necessary for the disembarkation of the astronomical expedition and its instruments, and then take the short route back to higher latitudes in order to continue the research. Deep sounding and temperature measurements of the water as well as faunistic research, if carried out in a systematic manner through the Indian Ocean, will have a special value for the recognition of the flow conditions of that part of the ocean. When your honor leaves the port of Mauritius around the middle of March 1875, you have to endeavor to reach the parallel of latitude of 30 ° by the shortest route in order, following the same, to cross the Indian Ocean to the east and both sounding and other observations to be carried out.

It is expected that S.M.S. "Gazelle" will set course from St. Paul to Mauritius at 30 degrees of latitude below the meridians of Kerguelen, so that this will offer an opportunity to carry out control observations, especially over depths, which should be used with all possible care. The sounding along the above parallel has to be continued until the moment when the temperature and current observations show in an unmistakable way that one has entered the cold current coming up on the west coast of Australia, which will be the case at about 112 ° east longitude. A closer approach to the Australian coast than is required by reaching the named meridian does not appear advisable, and the investigations should therefore continue following this meridian to the north until SMS "Gazelle" has rounded the northwestern tip of Australia, Northwest Cape (Exmouth Gulf).

During this part of the journey, your excellencies will be particularly attentive to the importance of thermal investigations according to the depth, which, in connection with the sounding, will provide important information about the extent and nature of the cold current on the Australian west coast and should therefore be carried out with special care . It is to be expected that "S.M.S. Gazelle " delayed by their work, will not reach those areas of the Indian Ocean until the north-west monsoons cease (at the end of April) and the south-east trade winds resume, to which the journey along the coast to the designated Points will not be associated with any significant difficulty.

If, contrary to expectations, it should prove necessary to renew the coal supply, I suggest you call at Nicols-Bay in the east of the Dampier Archipelago; I notice, however, that it has not been possible to find out whether coal will always be available in the small English settlement of Roeburne in Nickol Bay.

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The next line to be followed from the north-western cape, possibly Nicols-Bai, lies between this point and the southern tip of the island of Rotti. This island is to be bypassed on the west side and anchored in the Koepang-Bai on Timor. The shallow depth of the Indian Ocean on this line promises a rich yield of zoological material, which must be of all the greater value for faunistic research as it is close to the edge of the great bank stretching between Timor. New Guinea and the Australian continent. On the other hand, I would like to point out to your honorable friend that the journey along this route and through the Arafura Sea must be carried out with constant caution. Due to the shallow depth and the changes in the fairway, which are always caused by coral formation, this seems particularly necessary.

You want to use your stay in Koepang, which will fall in the middle of May, to obtain scientific material, which is available, and I particularly draw your attention to petrefacts that are found on these geologically little-explored islands, and refer for the details to the enclosed paper by Professor BEYRICH on coal-limestone fauna on Timor.

You will receive the following directives to follow up on the scientific research and to guide you in your choice of route.

It is my wish that July, August and the first half of September be used to visit the archipelago and the seas of Melanesia and to explore as much as possible in scientific ways. The islands mentioned here are initially understood to mean the group New Britain (New Pomerania) and New Ireland (New Mecklenburg), the Solomon Islands, Santa Cruz and the New Hebrides. From this last group of islands you have to take the course to Auckland on New Zealand and make sure that this port is reached towards the beginning of October next year.

There are two ways of carrying out this plan - either the course on the parallel of 10 ° through the Arafuru Sea and the Torres Strait to the Pacific or the route from Koepang through the Ombay Passage to the Flores and Sea of Celebes to enter the Sea of New Ireland (New Mecklenburg) and New Britain (New Pomerania) north of New Guinea.

The route through the Torres Strait, although at the time of year (June) when the "Gazelle" will have to take it, the southeast monsoon has passed, presents no serious difficulties for a vessel equipped with steam power. The south-east wind does not blow vigorously and persistently in those waters, and especially near the coast of northern Australia and to the north of the Gulf of Carpentaria and at Cape York it is slack and unstable; on the other hand, the new colony in Somerset (Albany) has the opportunity to replenish the coal supply. When navigating through the eastern part of the Arafura Sea and the Torres Strait, however, it is necessary to constantly watch the tides so that the current can be used to advantage.

Scientifically, this route is of great interest, because the current and temperature conditions on the surface and in the depths of the sea must give a lot of information about this connection between the Pacific and the Indian Ocean, and then also because the trawling and collecting of zoological samples on the Australian bank in connection with the investigations of the event..

Geological samples collected on Timor will give the most significant results with regard to the past of those coasts and sea depth. Also that part of the Pacific ocean between the southeast tip of New Guinea and the northeast coast of Australia is pure coral formations and therefore of great interest, quite apart from that of the other hydrographic conditions.

The other route through the Ombay Passage, the Flores Sea and the Pitt Strait is also of great scientific interest, especially if, at the given time, your Excellency should be able to explore the depths on the east coast of Celebes, which in in many ways form the dividing area of fauna between Asia and Australia, to investigate more closely.

After that I leave you, depending on the weather conditions, to choose from these two routes at your discretion the one which offers the most advantages for the achievement of the intended purpose "hydrographic exploration of the small island groups of Melanesia" according to season and available time promises.

Out of consideration for the groups in the northeast of New Guinea, I would like to draw your attention to the work of English surveying vessels (Hydrogr. Mittheil. 1873, pages 181, 188, 195 etc.) and I expect the work of S.M.S. "Gazelle" also in this direction, some completions and additions to what has already been stated about those regions.

I have the letters for S.M.S. "Gazelle" planned as follows: Until February 10, 1875, including from here. to Mauritius, so that the steamer coming from Aden will bring the last post there on March 14th. From 11. February 1875 to March 24th, 1875 including from here to Koepang on Timor, where you can expect the last post to arrive there around mid-May. From 25 March onwards, the letters will be sent to Auckland on New Zealand for you, and you will find the arrangements for further shipments there.

The chief of the admiralty.

signed BY STOSCH.

Third sailing order.

At the Royal Captain of the Sea and Commander S.M.S. "Gazelle", His Excellency VON SCHLEINITZ,

Berlin, June 23, 1875.

Auckland, New Zealand.

Your Excellency, please receive below following my sailing ordinance of November 13th. the following orders for further use and the return journey S.M.S. "Gazelle".

From Auckland, where your Excellency will arrive in the beginning of October, after the necessary stay there, you have the journey, calling at the Fiji, Samoa and Tonga Islands, to Punta Arenas in the Strait of Magellan, then to Montevideo and from there to England. I expect your arrival in Kiel in the first half of April next year.

The following compilation of the further scientific tasks for SMS “Gazelle "on this trip, Your Excellency should serve as a guide, and you have to pause the route indicated therein, as far as it can be fulfilled under the given conditions, and do the desired research, Make measurements etc.

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This route is based on the following points:

1. Consideration is also given to the soundings along the line which H.M.S. "Challenger", which has recently been active in the western part of the Pacific Ocean and will continue to do so in the northern and western parts in the near future, as well as on the routes and areas already worked by the "Gazelle".

2. It appears to be essential for a clear understanding and knowledge of the heat distribution in the ocean, both at the surface and at depth, it becomes clear that a series of reliable and thorough soundings and temperature measurements are carried out along a certain parallel of latitude. If this idea is carried out consistently, a comparative parallel can to a certain extent be obtained for the southern hemisphere with regard to the elements of hydrography mentioned, and the parallel of 30 ° south latitude was therefore selected as the most suitable and practical for this purpose.
According to the earlier instructions, S.M.S. "Gazelle" will have examined this parallel in the Indian Ocean for almost its entire extent, from the meridian of Mauritius to the entry into the cold currents of Western Australia, taking into account deep sea conditions, currents and temperatures. In the same way, the thirtieth parallel south latitude of about 178 ° west longitude from Greenwich to the entry into the cold Peruvian current is also to be made the object of close observation, as well as on the journey through the southern Atlantic Ocean, from the mouth of the Rio de la Plata to the Greenwich Meridian.

S.M.S. "Gazelle" on her further expedition, leaving Auckland at the beginning of October, first had to stand east away up to 170°W 30°S it is then in that region of the Pacific Ocean where, according to the views prevailing today, the New Zealand current is supposed to move south, to the east of New Zealand partially covered by drift currents, up to Viktoria-Land in the far south. Both direct current measurements on the surface and in the depth, as well as thorough temperature measurements have to be done carefully in order to finally determine the real facts. From the point indicated, the "Gazelle" has to change course and head for the Fiji Islands. The "Challenger" sounded the line from the east entrance of the Cook Strait directly to Tonga and from there to the Fiji Islands. For a more precise orientation, the results of the investigations are given here, insofar as they have already become known.

The communications of the "Challenger" also contains the following passages of interest: "On the 14th and 15th of July we were in the neighborhood of the Kermadec group, with 600 fathoms water, the bottom composed of coral, pebbles and pumice, proved more than usually dangerous for the trawl, but we succeeded in working it without accident. The weather prevented our obtaining any soundings between these islands and New Zealand, it is therefore still doubtful, whether there is deep shallow water."

The "Gazelle" could fill these last-mentioned gaps on its journey, and the command is particularly alerted to this, as well as to the importance of the control operations between the Kermadec and Tonga Islands. She will be particularly attentive to the route of the "Challenger" on command and almost in the middle between the northeast end of New Zealand and the Kermadec.

For the second time the route of the "Challenger" will be crossed near the point at which the greatest depth plotted by the English observation ship is recorded (2900 fathoms). Along the line, complete series of observations are to be carried out and, taking this into account, the Journey to Ovalan will take 22 days. Coals will probably be available in Ovals, at least this was the case with the presence of 1st HMS “Challenger”. After a stay of four or five days in Ovalan, SMS "Gazelle" will have to start the journey to the Samoa Islands. With due regard for this, your best wishes are welcomed to the relevant reports of the commander SMS "Arcona", Baron VON REIBNITZ, in the hydrographic Notices No. 23, 1874, with important hints contained in it. Although SMS "Arcona" made the trip in May (from 17th to 27th), the "Gazelle" shouldn't make any significant difference with regard to occasion and duration of the trip in early November where she will be in these waters.

Along this stretch, according to the Admiralty maps of wind and currents, at the end of October and beginning of November there will often be an easterly wind prevailing, although the influence of the southwest monsoon is very noticeable and the southeast trade wind has broken up in places. Observations of wind, weather and barometer readings are of particular importance for shipping in those areas, and the "Gazelle", although and perhaps precisely because it visits it in the hurricane-free time, can make many important contributions, at the same time with consideration for new Guinea, divides,

In all likelihood, coal will be available again in Apia or Tutuila in the Samoa Islands. After a stay in one of these ports of four to five days, the "Gazelle" has to take its course to Tonga under constant observation and should endeavor to reach the 30th parallel in latitude from the latter island, where a short stay also has to be made Close to their route from Auckland to the Fidji's in order to be able to carry out controls etc. again.

The next destination is the small island of Oparo, which, following the parallel of 30 °, can be reached in the first days of December.

It should be possible to obtain coal in this small port, which for a time served as a coal station for the now re-established steamer line between New Zealand and Panama, but this is by no means certain. The further journey along the 30th degree S to the Peruvian Current and 80 ° W, where in November and December the winds are predominantly northwest and southwest, should not require excessive time expenditure, even if on a more southerly course from Oparo the "Gazelle" would be led quickly to the western winds and could reach the Strait of Magellan more quickly.

For the reasons given in the introduction, however, it is absolutely desirable to investigate depth, temperature and current conditions on the 30th parallel to the latitude, and only note that in the case of headwinds SMS "Gazelle" should deviate from this on the polar side of the parallel mentioned. On this course and under the scientific work to be carried out at Pitcairn Island, approximately below the meridian of 130 ° W, a strong, southward-leading current is indicated; A survey of its existence, strength and temperature would be very welcome - if the corvette could arrive at Cape Pillar at the western entrance to the Strait of Magellan in the first days of January 1876 and begin the investigation of this Strait. This preferably had to be limited to the determination of the physical conditions, since the time required for recordings is not allowed for.

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Punta Arenas is to be approached, partly to take in coals that are available there, even if of poor quality, partly also. to make all shipping inquiries about the Strait of Magellan. It would be desirable to obtain reliable determinations of the magnetic elements from this port, since the increasing traffic of iron ships in the Magellan Strait requires a more precise determination of the values of the same, in order to be able to deduce the elements important for the deviation changes.
S.M.S. "Gazelle" has to make her journey home through the Atlantic Ocean from the eastern entrance of the Magellan Strait, Cape Virgins, in the middle of January. As useful as it would be to take the course next to the coast of South America in order to make observations of current and temperature conditions, it is nevertheless advisable, because of the prevailing north winds and the south-setting current, to travel to the mouth of the La Plata (Montevideo) to be set up in such a way that the Falklands Islands are just passed in the north and the course is taken in a wide arc, approximately to 46 ° S and 50 ° W, after the Rio de la Plata, The Importance of this route means you should allow about 14 days, the places where it cuts through the southward setting, warmer current, namely just west of the Falkland Islands and south of the La Plata estuary. Observations of the current, specific gravity, and temperature are to be made before the latter.

At the beginning of February the "Gazelle" will be able to leave the La Plata estuary again to continue observing the current, depth, temperature and bottom conditions up to the meridian of Greenwich, possibly following latitude 30 degrees south. On this occasion, the course of the "Gazelle", which it followed on its departure from the Congo to the Cape of Good Hope, will be touched, and it is desirable that the comparison measurements be carried out at the point of contact or intersection. If those points were reached in the last days of February, it is advisable to take the course from them to Penedo de St. Pedro (29 ° W),
SMS "Gazelle" carried out a number of soundings on the way out from the Equator to Ascension and from there to the Congo, and on the communication of the relevant results the assumption was made that from Ascension to Penedo de St. Pedro the elevation to the east of it was ascertained of the sea floor continue in the shape of a hook. It would therefore be of particular interest to follow these investigations on the points observed on the outward journey. The interest which is attached to these investigations is increased by a recent observation made by Lord LINDSAY'S expedition at the points in question of the Atlantic Ocean a sudden surge of water was perceived, which is said to have resulted in a substantial decrease in the specific gravity of the sea-water. It is possible that this was an eruption of a new undersea crater, which the investigations S, M.S. "Gazelle" will be able to provide important information. Assuming that the "Gazelle" will be able to leave latitude 30. South at the end of February, it will cross the Equator in mid-March and can therefore reach England at the beginning of April, since no further systematic marine surveys are carried out in the northern Atlantic Ocean From where the arrival is to be reported to me by telegram.
The general scientific instructions, which were drawn up by the hydrographic bureau for S.M.S. "Gazelle", contain everything necessary about the scope of the investigations to be carried out; and therefore there is no need for any further explanation on this subject.

Finally I must add some comments based on an article on hydrography referenced in the "Guide to Scientific Observations while Traveling." The following can be said about what can be surveyed and investigated along the described route from Auckland through the Strait of Magellan to Europe:
The sea captain Freihern von REIBNITZ speaks about Apia in his report of December 1, 1874 that on board S.M. S. "Arcona" has been determined by sounding that the Bank, which extends west from Apia has a greater extent than is indicated in the map Tit, XII No. 162, as it is still about 2.6-3 nautical miles north of this bank 14 to 16 meters of water were found, while according to the map there should be 55 to 65 meters of water. Furthermore, Captain VON REIBNIZ states that according to the map, which was drawn after rather imprecise measurements from the year 1839, almost all mountain peaks are 1 to 2 nautical miles wrong, so that the bearings never matched. Good settings and directional lines, as well as sailing instructions would have to be made here. Otherwise, it would also be very desirable if on some of the islands of the Samoa group, namely in the port of Apia and Pago-Pago, the most precise location possible would take place, on the basis of which a survey could take place.

With this disposition in mind, I have had the mail for S.M.S. "Gazelle" arranged as follows. Letters go to Auckland from here up to and including August 15th, and you will receive the last ones in Auckland with the steamer leaving San Francisco on September 11th, which will arrive in Auckland on October 8th. From then on, they will go to Punta Arenas until November 11th, including Punta Arenas, where you will receive the last post with the steamer leaving Liverpool on November 17th around December 22nd; soon until December 24th including to Montevideo, where you will receive the same steamer leaving Liverpool on December 29th on January 26th, and then to Plymouth in England.

I am looking forward to the reports from your Excellencies on the execution of the scientific work etc. from the various ports.

The chief of the Admiralty. signed by STORCH.