

Hülsmeier's early radar commitments

Arthur O. Bauer

Foundation "Center for German Communication and related technology 1920-1945"
Pater Pirestraat 29, 1111 KR Diemen (NL)
aobauer@xs4all.nl

Abstract: This year is it exactly a hundred years ago that Christian Hülsmeier of Germany patented, on 30 April 1904, the first basic elements of what we call today "radar". He and a business associate established the "Telemobiloskop-Gesellschaft", who soon gave two public demonstrations, first in Cologne (May 1904) and second in Rotterdam (June 1904). However, we also will heed why the state of the art of Hülsmeier's technology, finally, forced him to give up his Telemobiloskop ambitions.

Keywords: Radar History, Telemobiloskop, Hülsmeier

1. Introduction

Since World War Two, Christian Hülsmeier's name (1881-1957) is becoming well known for his commitments in early radar experiments, about the year 1904. Reading the available sources on Hülsmeier's demonstrations, I came soon to the conclusion that most references were quite fuzzy. On one hand these were relying on early 1900 periodicals, and some had been based on Hülsmeier's post war reminiscences. David Pritchard's book "The Radar War" of 1989, became a very popular source of information. Notwithstanding, it proved that he used mainly the same references as others did before him. Pritchard had, however, access to Hülsmeier's family archive in Düsseldorf but, as we will see, this archive was also a source of inaccurate information! During my historical survey on Hülsmeier's radar involvements in the early years of the 1900s, it became clear to me that historians not necessarily have to be acquainted with electrical engineering and, that patent specifications can be a very relevant source of information.

2. Hülsmeier's early patents

According Hülsmeier's daughter Annelise her father moved in April 1902 to his brother Wilhelm in Düsseldorf. In contrast to what I have unravelled during my survey, she stated *...Christian is setting up an electrical firm that enabled him to carry out further research into reflection techniques, and to build a transmitter and receiver to purpose he had in mind. But this needed more money than was available. In the end he placed an advertisement in a local (Cologne?) newspaper*

for a financier to back him in an "epoch-making discovery". A Cologne leather merchant saw it and showed interest.... [1]

Although this story sounds reliable, it proved to be quite inaccurate, as Hülsmeier's first patent applications dealt with an optical voice recorder (according his US patent application it was called "Telephonogram") and the second patent was carried-out in cooperation with his brother Wilhelm and concerned an "advertising van"! [2] And, Mannheim was, according a reliable source, not a leather merchant but a financier. [3]

However, we may be very lucky that Hülsmeier's daughter Annelise was very dedicated to her father's inventions. In 1981 (Hülsmeier's hundred's birthday) she wrote a letter to the Patent Office of Berlin asking them if they could provide her some details of her father's early patent applications. Luckily, they replied the letter with a list of applications, including the ones that had been rejected. Which latter details, consequently, can never be traced in patent registers!

Relevant in our context is Hülsmeier's first wireless related patent application. It claimed: to prevent from signal interference with remote-controlled ignition of explosives at distance. [4]

From the letter of the Patent Office we know, that he had applied, between 1902 and about mid 1904, for more than eighteen patents in Germany, neglecting the ones abroad. Of which nine were rejected (some were, after modifications, accepted later).

The Berlin letter explained also, that Hülsmeier's first radar like patent application (already called a Telemobiloskop) dated from 21 November 1903, but that it had been rejected, in first instance. Why, we might never know, as they regularly delete such kinds of records after a period of ten years (thus in 1913). [5]

I could not trace any information on Hülsmeier's Telemobiloskop project between November 1903 and its successful (second) application on 30 April 1904.

However, he must also have been involved with a modified version of his interference rejecting command-system (DE152141) as he, successfully, applied for a patent which was granted in the United States 810150, filed on 14 March 1904.

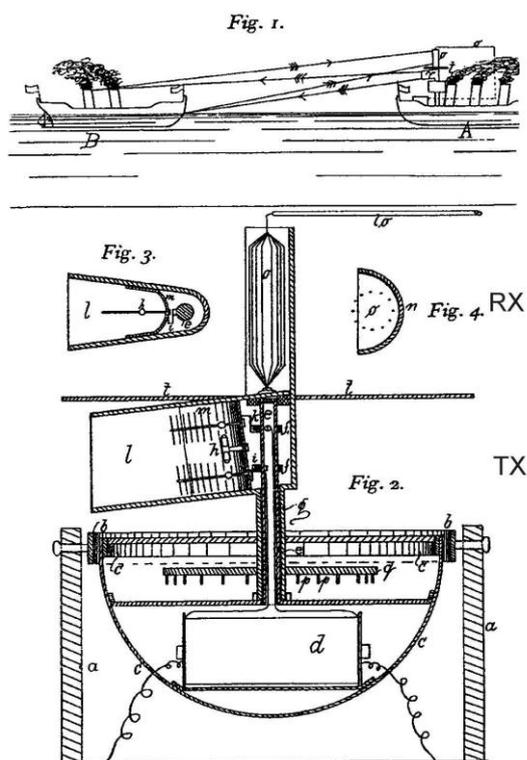


Fig. 1 patent drawing DE165546

In my opinion, his most famous patent must have been DE165546, which we may regard to be the world's first radar related patent application. Let us follow briefly some specifications of the British version GB13170, which they remarkably quickly granted it on 22 September 1904!

Its genuine specification (claim) was:

Herzian-wave Projecting and Receiving Apparatus Adapted to Indicate or Give Warning of the Presence of a Metallic Body, such as Ships or Train, in the Line of Projecting of such Waves.

Some lines below he continued:

My invention is based upon the property of electric waves of being reflected back towards their source on meeting a metallic body, and will be readily understood by imagining a transmitter and a receiver station such as indicated placed side by side at the same point and so arranged that waves projected from the transmitter can only actuate the receiver by being reflected from some metallic body, which, at sea, would presumably be another ship.

My apparatus comprises a transmitting and a receiving station similar to those used in wireless telegraphy, with this difference that the two stations are situated in close proximity to each other and are so arranged and constructed that they cannot directly influence one another.

What can we learn from this quite clear description?

First of all, it would appear that he did understand the basic principles of radar very well. Secondly, that one had to adequately separate the transmitter from the receiver installation. The patent drawing shows clearly how he thought that this could be accomplished.

The transmitter antenna was placed in the focus of a kind of parabolic reflector, which was placed at the far end of a conical horn arrangement. The receiver antenna was placed in the focus of a parabolic cylinder.

Let us continue further down the specification text:

In view of the fact that ships are at times subject to considerable rolling, pitching and like motion, which might otherwise render the apparatus practically useless. I mount both the transmitter and receiver similarly to a compass-box, about as shown in Fig.2a, so that they are maintained by action of gravity in an approximately vertical position. ...

This kind of construction is also known as Cardan-suspension. He had obviously thought carefully about the need for a stable platform for the instrumentation.

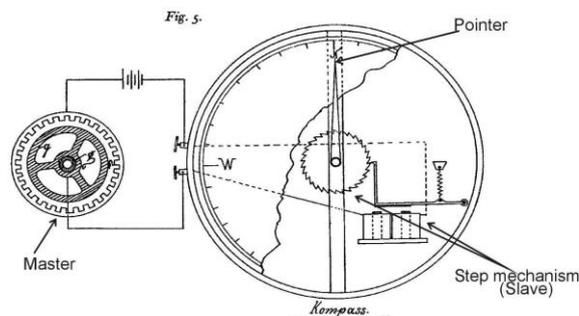


Fig. 2, panoramic scanning

So far, the specifications of his apparatus sound rather good, but his ultimate objective was after all to create a system to prevent ships colliding. As the danger of collision is, more or less, equal from any quarter, he thought that it was obvious to look at all directions. Consequently, he provided on his Telemobiloskop system a continuously rotating mechanism.

For whatever reason, the British patent drawing does not show these details, in contrast several other patent applications abroad.

The so-called "Kompass" employs a rotating pointer, which rotates in concert with the real detecting beam. Its continuous movement is synchronized with that of Hülsmeyer's platform.

We can learn from it that Hülsmeyer had invented, already in the year 1904, the basic ideas of which became later known a "panoramic scanning", and PPI (Plan Position Indicator) after a range measurement could be added to the system.

3. Funding of the “Telemobiloskop-Gesellschaft Hülsmeier & Mannheim” and experimental trials

As we could not trace, in Hülsmeier’s remaining family archive, any advertisement placed by Hülsmeier to find a financial back up, we have to rely on what is available in print such as newspaper and magazine articles from the early years of the past century, among these are also some official documents.

Hülsmeier and his business partner established the “Telemobiloskop-Gesellschaft Hülsmeier & Mannheim”, and started its (legal) business on 5 May 1904. [6] It is said, that Mannheim shared with 5000 marks in their mutual enterprise.

It is evident that they, as soon as possible, wanted to approach the future market with their Telemobiloskop apparatus, which claimed “ a system to prevent ships colliding”.

The first newspaper articles on their undertaking appeared on 18 May in Cologne newspapers.[7] But, recent findings on microfilm in the Municipal Archives of Cologne reveals to us more precisely, what happened during Hülsmeier’s radar demonstrations in the Domhotel on Tuesday afternoon of 17 May 1904 and how Hülsmeier approached his lay audience.

Let us refer, briefly, to some of the newspaper reports:-

The gathering in the venue (the courtyard of the hotel) started at 11 o’clock. Present were representatives (Oberingenieure = senior engineers) of Norddeutsche Lloyd and the Steam-ship Company Argo (both of Bremen) and, presumably, several other individuals as well. One newspaper issued the well-known text about the principles and the expected performance (range) of three to five kilometres.

There is, however, one exception and that is the account found recently in the Kölner Tageblatt of 18 May 1904. [8]

Continuing the observations of the eyewitness:-

The receiver was placed on top of the transmitter and both had been separated by means of a metal plate. By this means it was ascertained that the receiver could not pick up the transmitted signal directly, but only after the EM waves had been reflected back towards the receiver. It seemed to be a relatively small apparatus.

The main gate into the courtyard, at about 10 metres distance, was used to demonstrate the reflecting phenomenon on metal bodies. During the demonstrations, a curtain was placed in the path of the EM waves so as to prove that such kinds of waves could travel through non-conducting materials. Thereafter, Hülsmeier placed his apparatus behind a brick wall (Sockelmauer) in the Hotel (garden?) and showed, that his signals still could travel freely through this type of obstacle.

The reporter continues (a briefed translation) :

“After the transmitter had been activated, and the waves returned to the receiver after reflection at the gate door,

the receiver switched on a light bulb which also initiated the activation of a small motor-mechanism (Laufwerk). This motor mechanism rotated and triggered the explosion of a few cartridges!”

It seems that Hülsmeier used a kind of receiver which was similar to, or derived from, either the interference rejecting system he had patented in 1902, or the modified version of 1904. He might have chosen this kind of set-up to excite the attention of his audience.

It is also interesting to know that Hülsmeier had already discussed the application of his system in future warfare.

This newspaper reports did not mention, in contrast to other sources, the demonstration near the banks of the Rhine, from or under the Dom Bridge but, it is quite likely that Hülsmeier’s guests went to the river Rhine banks after the introduction at the Domhotel as this was only about five minutes walk away.

Post war references, mistakenly, mention “Hohenzollernbrücke” though, they have built this bridge between 1907 and 1911! The grand old man himself said, in a recorded radio interview of 1954, correctly: ...Ich habe dann auch noch in Köln die Apparate unter der Rheinbrücke auf dort vorbeifahrende Schiffe vorgeführt,..... Translated briefly: I have also demonstrated my apparatus under the Rhine bridge in Cologne detecting passing ships.... Those who have used (introduced) the venue near or under the Hohenzollern bridge, might not have been aware of the historical “contradiction in terms”.

We noticed that Hülsmeier had combined, for this occasion (at the DomHotel at least), his Telemobiloskop system with his wireless remote-control apparatus. These historical circumstances might have caused, in post war years, quite some confusion. Many thought that the wireless remote-controlled apparatus (with its interference suppression system) had been similar to Hülsmeier’s radar receiver. Which, in my opinion, is more than doubtful!

4. The Rotterdam experiments

However, Hülsmeier’s demonstration in Cologne soon attracted the attention of Mr J.V. Wierdsma, the CEO of the Holland-Amerika Line of Rotterdam in the Netherlands. During the researches lead with the help of Adri de Keijzer from Delft, we have found comprehensive correspondence between the major trans-Atlantic ship lines, about safety of their vessels (and passengers). Consequently, Wierdsma invited Hülsmeier, after due considerations, to demonstrate his apparatus during a harbour tour to the attendees of the Nautical Conference on 9 June (1904), which was held in Scheveningen, between 8 - 10 June.

To show the results of Hülsmeier’s demonstration in Rotterdam harbour, we rely on the minutes of the conference (neglecting, for this occasion, other available sources): [9]

The Telemobiloscope

During the visit of the delegates to the establishment of the Holland-America-Line at Rotterdam, a trial was given on board the tender Columbus to the Telemobiloscope, an invention of CHRISTIAN HÜLSMEYER Esq. Engineer at Düsseldorf.

This apparatus is based on the principle of wireless telegraphy and is intended to ascertain when at sea, the direction and also the distance of an other vessel.

In wireless telegraphy the distributor and the receiver are part of different places, in the Telemobiloscope they are placed together on the same spot. The electrical currents of the distributor however cannot be caught by the receiver directly but must strike an object of metal (in this case the other vessel) before returning to the receiver. The opinion of the inventor is that vessels fitted with his apparatus, can discover at night or in a fog etc., at a distance of up to 3½ miles, other vessels and ascertain the position of these vessels. The trial on board of the Columbus, though on very limited scale and with an unfinished apparatus, proved that the principle of the inventor is correct. Every time when, even at certain distance, a vessel passed, the apparatus operated immediately.

The apparatus used in this trial was not yet arranged for determination of the distance.

The last sentence is, in my opinion, rather important, as we notice that they must have discussed the necessity of measuring distance.

After Hülsmeier returned home in Düsseldorf, he started working (among other things) on a way to measure distance. One of his ideas was, (we consider his second specification (of DE165546) in which he utilised a platform-stabilisation, as to keep the apparatus in a vertical position) to tilt the entire platform by means of a movable counter-weight, as to change the electrical system horizon. When the height and the tilt-angle are being known, a simple trigonometric equation can provide the distance between ship and target. We neglect, for this occasion, his second claim consisting of a dielectric antenna arrangement. On 11 November 1904 it was filed a German patent DE169154, which is similar to GB25608 of 24 November 1904.

Significant is, in my opinion, that he found a way to measure distance, without the necessity of the factor 'time' (during WW II some German radars used similar systems)!

5. A second campaign at Hoek van Holland

It was believed until recently, that Hülsmeier's revolutionary Telemobiloskop apparatus came too early, as technology could not yet cope with the very technical difficulties. This may well be true though, recent discoveries in a Dutch archive, allow us to get an unprecedented inside view as to what the circumstances were in those days.

However, during our research in the HAL archives, we found the minutes of meeting of the next Nautical Conference, which has been held in London one year later on 8 and 9 June 1905. [9]

Among the many topics, they commented on Hülsmeier's apparatus:-

The Telemobiloscope

A new trial at the Hook of Holland had been a failure. One of the Delegates reported also that the principle on which the apparatus is based proved to be an error, so that probably nothing more will be heard of it.

This was the first concrete evidence that Hülsmeier had experimented with his system sometime after he demonstrated his apparatus, to the audience in Rotterdam, on 9 June 1904.

It was evident that we had once again to examine the HAL archives! It proved that the presumptions had been correct, as we found Heinrich Mannheim's hand written letter of 16 September 1904 on behalf of the Telemobiloskop-Gesellschaft.[10]

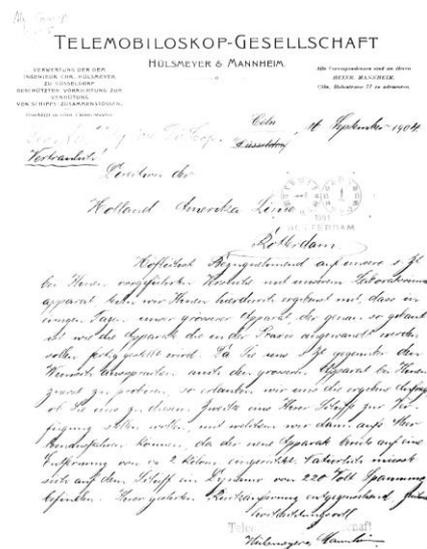


Fig. 3 - Mannheim's letter of 16 September 1904

It is plausible that Hülsmeier had built, between mid June and the second week of September, a more sophisticated system and that they lost no time in letting the HAL Company know of these improvements.

Let us briefly consider its contents:-

“Mannheim addressed this letter to the management of the HAL Company.

He considered that they already knew about their “laboratory” apparatus. He then respectfully informs them that, in a couple of days, the new more powerful apparatus will be ready for demonstrations. This will be the version for their future commercial installation.

As you (Wierdsma?) have suggested, we should first test our apparatus in your ships. He then respectfully asked

them if they could provide one of their vessels for their second practical trial now to take place at sea. Mannheim further points out that their apparatus could now cover a range of circa 2 miles" (equal to 3.2 km, or if nautical miles were concerned 3.7 km).

A few days later (22 September) Wierdsma replied to Mannheim: " We have received your letter of 16th of this month. We are willing to assist with your second trial of the Telemobiloskop on board of the same ship-tender Columbus but, in waters in which we may expect larger distances between ships. Should this experiment be successful, then we could install the Telemobiloskop on board of one of our sea-tenders or, on one of our steam liners. In the latter case, during the trip to and from New York". [11]

We have not been able to trace any further correspondence between Hülsmeier cs. and Wierdsma. Consequently, we may presume that there had been no further communications at board levels.

6. Why did Hülsmeier ultimately fail?

Without any precision about this second campaign near Hoek van Holland, other than the few but definitive words of the London meeting minutes, we must consider that it ended on a failure. I would like to explain why, in my opinion, this failure could have occurred.

If we examine Hülsmeier's wireless related patent applications, then we can conclude that he had made no provisions for selectivity. This, of course, was not too much of a problem in the early days of wireless technology. However, this proved to be a downside which soon became quite a major obstacle for improving the specifications of his apparatus. Why had he not simply added some provisions onto his patent applications in order to keep-up with the selectivity concerns?

There were two very major (fundamental) obstacles. One was Ferdinand Braun's patent DE111578 from 14 October 1898 in which he introduced a primary tuned circuit which is inductively coupled with the secondary antenna circuitry. This principle enhanced the transfer of energy enormously. Notwithstanding, that Oliver Lodge had already claimed tuned circuits some months earlier, he did not claim the insertion of a transformer circuit between the spark-gap and the antenna.

The second severe obstacle was Marconi's famous patent 7777, which is also known as the Syntony patent. He had applied for it on 26 April 1900. It claimed:

Improvements in Apparatus for Wireless Telegraphy

Technically speaking, it had much in common with that of Ferdinand Braun which was claimed in 1898 except that Marconi had added the tuning of the primary and secondary transformer circuits.

The early days of the wireless industry was quite cut throat! The Marconi Company tried, by whatever means, to monopolize the world's wireless industry. They started

with claiming everything related to the transfer of electromagnetic (EM) waves.

On the other hand, we have seen previously that Hülsmeier's separated transmitter and receiver system (adequately) from each other so that only reflected signals could reach the receiver apparatus. It is obvious that, Hülsmeier, would have generated large spark-trains in his transmitter apparatus. As he had to bridge the distance twice, transmitter → reflector (obstacle) → Telemobiloskop receiver. We may also presume, that he was not familiar with the implications of what became known as "the Radar equations".

However, Hülsmeier's receiver utilized a coherer detector arrangement in conjunction with a wide-band-antenna-circuitry. Consider also the situation which would prevail in today's environment with a sensitive coherer connected to open circuitry, bearing in mind that the coherer was permanently in "switched-on" mode! Today's pollution of our radio spectrum would lead to insurmountable difficulties!

But what could have happened in Autumn 1904 at Hook of Holland, when his trials ultimately failed?

There were several coastal wireless stations in existence not too far away from the site which he might have used for his experiments. These environmental conditions might have played a significant role in respect of Hülsmeier's wireless experiments near Hook of Holland. Hülsmeier would have been able to generate sufficient RF energies such that his rather broad-band signals could very well have interfered with other wireless signals. He might well have been banned from the air, by legal measures. From about 1903/1904 onwards the national authorities started to generally licence wireless systems. Particularly after the 1906 Berlin Conference, all systems onboard ships had to be built according the "State of the Art" requirements of those days.

7. What did Hülsmeier after the Hoek van Holland disaster?

It is little wonder that Hülsmeier and his business partner wanted to involve the newly established Telefunken Company. In my opinion, I don't think they considered this step in the early stages of the Telemobiloskop Company but, they decided to give it a try after they had failed to commercialize their Telemobiloskop apparatus (about late 1904). Of course, it might well be that it was initiated by Heinrich Mannheim himself, as a move to get back some of his investments in Hülsmeier's inventions (5000 marks).

However, they received shortly after 21 August 1905, a very disappointing letter from Telefunken [12]:-

Dear Sir,

Please find enclosed the patent specifications you kindly offered us short time(some time ago, AOB) ago for A System of Reporting Distance Metallic Objects to an Observer and the addition to Patent No 32910 VIII/74d by Christian Hülsmeier of Düsseldorf.

We return these with our best thanks as we have no use for the above discovery(invention,AOB)....

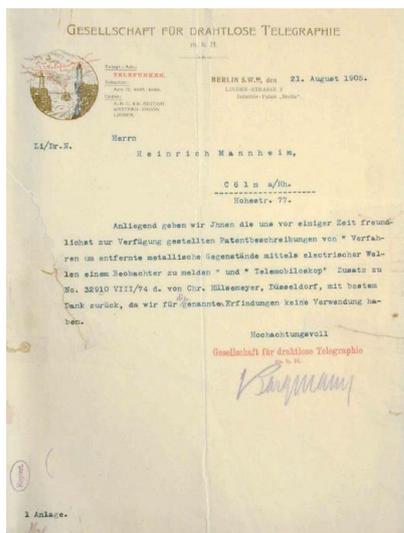


Fig. 4 Telefunken letter of 21 August 1905

To some extent it is understandable that Telefunken did not respond positively. This recently established company (15 July 1903) had so many commitments in the field of wireless, that Hülsmeier's invention might have been outside of their business targets. On the other hand, it is possible that the Telefunken representatives, given the task of judging the Telemobiloskop subject, didn't grasp the implications of Hülsmeier's basic principles.

It is not wondering that Hülsmeier's ambitions, to commercialize his radar like inventions, must have come to an end on 11 October 1905. On this day he, certainly disillusioned, went to the Royal Court of Cologne to erase the name of the Telemobiloskop-Gesellschaft Hülsmeier & Mannheim, from the business register. [13]

8. Conclusion

We have followed in this brief paper, some of Hülsmeier's approaches and struggles in the early field of radar. We have also noticed that Christian Hülsmeier's first steps in the world of patents had not been related to radar like technology and, that they had rejected his first Telemobiloskop application of November 1903. However, his second approach on 30 April 1904 was successful. According the last text line of the minutes of meeting of the Rotterdam demonstration, we may presume that they had discussed the necessity for determination of distance. We have also seen that Hülsmeier, soon after the Rotterdam demonstration of 9 June 1904, had filed a patent for measuring distance between his apparatus and metallic targets, in November of that year.

That Hülsmeier ultimately had to fail with his Telemobiloskop concept is evident, as two, insurmountable, legal obstacles stood in his way, these

patents were owned by both Ferdinand Braun and Marconi.

Although not being mentioned in this paper, it had been Heinrich Hertz's work carried out between 1884 and 1888, that paved the way for Hülsmeier's technology:-

We must, in my opinion, give credit to Hülsmeier for having specified the first basic elements of radar, in the year 1904.

Although, the Germans, sometimes in the 1950s, regarded Hülsmeier's radar-like apparatus as the "Ur-Radar" type. [14]

Even though it was Heinrich Hertz who used, during some of his scientific experiments in Karlsruhe (1886-1888), the phenomenon of EM wave reflection at conducting objects for the first time. But, the "grand man" never considered an application to patent his discoveries!

References

- [1] David Pritchard, The Radar War, p. 15
- [2] US766355 and DE146879; the advertising-van got DE147591 filed 7 September 1902
- [3] "Greven's Adressbuch" (address book), available on microfilm at Köln (Cologne) Municipal Archives. It reveals also that Mannheim's wife became long after 1904/1905 engaged in the leather business.
- [4] DE152141 filed on 5 November 1902
- [5] H 31 800 Kl 21a (the first character 'H' stands for Hülsmeier)
- [6] According: Königlichen Amtsgericht in Cöln of 7 July 1904, official document copy
- [7] For example, Kölnische Zeitung, Städtische Nachrichten 18 May, Stadtanzeiger zur Kölnischen Zeitung, Mittwoch 18 Juni 1904, Morgenausgabe (morning issue)
- [8] Kölner Tageblatt, 18 May 1904 (available on microfilm at Cologne Municipal Archives)
- [9] Rotterdam Municipal Archives (GAR), Directie HAL, inv.nr 1470
- [10] Rotterdam Municipal Archives (GAR) V Directie HAL, inv.nr. V 4-1
- [11] Rotterdam Municipal Archives (GAR) V Directie HAL, inv.nr. V 58-volume 21
- [12] According Pritchard's translation, p.20
- [13] Königliches Amtsgericht (Royal Court), Köln, III/1 HR, Amts 3706/6
- [14] Ur = prehistoric