Tidsskriftet Tidsskrift for Den norske legeforening

Sandborg-Vedeler's forceps – an innovation in the golden age of obstetric forceps

MEDICAL HISTORY

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Background

Obstetric forceps came into common use in the 18th century and for a long time were the only instrument capable of saving both mother and child when labour failed to progress. Countless variations were developed to improve their function, including the Norwegian Sandborg-Vedeler forceps. What problem were they designed to solve, and why are they kept at the Science Museum in London?

Material and method

We searched for information about the Sandborg-Vedeler forceps in digital archives and literature reviews, reviewed the proceedings of *Det norske medicinske Selskab* (The Norwegian Medical Society) for the period 1872–1907, and communicated with international experts.

Results and interpretation

The Norwegian doctors Christian Sandborg and Berendt Vedeler presented their new forceps in 1874. They were designed to achieve a biparietal grip on the foetal head when it was unengaged in a transverse or oblique position. The instrument attracted limited interest and was seldom used. Alongside the world-famous Kielland forceps, the Sandborg-Vedeler forceps are the only Norwegian-designed forceps to have left a notable mark on history. Sandborg and Vedeler developed several variations of the instrument, and in 1929, Professor Kristian Brandt of the Department of Obstetrics and Gynaecology at Rikshospitalet donated six pairs to the Wellcome Historical Medical Museum in London. He believed the inventors demonstrated a deep understanding of the mechanism of childbirth and exceptional mechanical skill.

Main findings

The Sandborg-Vedeler forceps were developed in the 1870s for use in deliveries where the foetal head was unengaged and in an oblique position.

The design was a collaboration between the doctors Christian Sandborg and Berendt Vedeler, who were based in Norway's capital.

Although their use was limited, they remain the only Norwegian-designed obstetric forceps – apart from the internationally renowned Kielland forceps – to have made a lasting impact.

In 1929, Professor Kristian Brandt of Rikshospitalet donated six pairs of forceps to the Wellcome Historical Medical Museum in London.

Few medical disciplines have undergone such a radical transformation due to a single instrument as obstetrics did with the introduction of forceps: they made it possible to save both mother and child (1).

In Europe, forceps came into use in the 1730s. Modifications quickly followed, and in the 1740s debates began about indications and techniques. The late decades of the 18th century and the entire 19th century marked the golden age of obstetric forceps (2). In Norway, forceps were likely first used in 1748 (1), but they were not widely adopted until the second half of the 19th century (3).

Over 600 types of forceps have been described, ranging from the long, large models used in continental Europe to the shorter versions in England (4). The instruments varied in terms of cephalic, pelvic and perineal curvature, size, blades, shank, lock, handles and fenestration width. The situation was further complicated by manufacturers supplying seemingly identical models in different sizes (3). Some forceps represented genuine advances, but most were

variations of little practical significance. Nevertheless, the effort to develop better forceps should not be underestimated. For a long time, forceps were the only instrument capable of saving both mother and child when labour failed to progress (3), and it has been claimed that obstetric forceps have contributed more to relieving human suffering than any other surgical instrument (5).

A particular problem was the use of so-called high forceps, meaning the application of forceps before foetal engagement. This type of forceps delivery carries a high risk of complications and is no longer practised, but it addressed a significant clinical challenge in the 19th century. At that time, forceps were the only available aid in such situations.

It was not until the 1950s that other operative delivery techniques began to take over (6). In Norway, vacuum extraction became an alternative to forceps for vaginal operative deliveries around 1960, and by the late 1970s, caesarean section had become the most common method of operative delivery.

A Norwegian doctor, Christian Kielland (1871–1941), achieved worldwide fame for his forceps design. The Kielland forceps are still mentioned in textbooks on practical obstetrics (7). However, there were several other Norwegian forceps designers. In studying the history of forceps (1–3, 6, 7), we became aware of the Sandborg-Vedeler forceps, designed in the 1870s by doctors Christian Sandborg (1829–1907) and Berendt Vedeler (1836–1909). What problem were these forceps intended to solve? And why are several pairs of them kept at the Science Museum in London?

Material and method

We reviewed the available literature on the Sandborg-Vedeler forceps, including searches in the digital databases PubMed, Google Scholar, Web of Science, the media archive Retriever and the National Library of Norway's online catalogue. We examined the proceedings of *Det norske medicinske Selskab* (The Norwegian Medical Society) for the period 1872–1907, which are not digitised. We also studied literature reviews of obstetric forceps (4, 8, 9) and consulted obstetric historians Bryan M. Hibbard (1926–2021) in Cardiff and Bo S. Lindberg in Uppsala, as well as the Science Museum in London. Two of the literature reviews state that no information on the forceps exists (4, 8), but they were presented at meetings of the Norwegian Medical Society in both 1874 (10) and 1879 (11, 12).

The new forceps are presented

In February 1874, Berendt Vedeler demonstrated the new forceps at a meeting of the Norwegian Medical Society (10). This is the first and only detailed account of the Sandborg-Vedeler forceps. At the time, Vedeler was a senior registrar at the Maternity Hospital in Christiania (now Oslo). His talk was

published over 15 pages in the *Norsk Magazin for Lægevidenskaben* and included four woodcut illustrations (10). The presentation is thorough and filled with technical detail.

Vedeler stated that, with the help of Dr Sandborg, he had created several versions of the forceps (10, p. 55). It is unclear how many variants were produced, but based on the available images, there appear to be at least five.

Since there were already 300 different types of obstetric forceps in existence, another addition might have seemed superfluous, Vedeler noted. However, the sheer number was perhaps clear evidence that 'the goal intended to be achieved with the forceps had still not been reached'. One of the illustrations showed a sketch of the instrument, indicating the English lock (characterised by a right-angled groove on each arm at the crossing point) (3), the size of the handle and the shortest blade (10, p. 55).

In a discussion at the Norwegian Medical Society five years later, in February 1879, Vedeler stated that he had delivered eight women using the new forceps. The indication was that the foetal head was in a transverse position in the pelvic inlet (11). Vedeler also mentioned the forceps from the Frenchman Tarnier, as he had experience with both, which was rare as these were seldom used in Norway. Vedeler agreed that his own forceps were too difficult for beginners to use, but he firmly believed that forceps should not be designed to suit the needs of the novice (11, p. 35). Many new forceps proved challenging to handle, including Kielland's forceps, which were introduced more than 30 years later (7).

At a meeting in May 1879, a letter was read aloud from the other inventor, Sandborg, in which he asked the chairman to present two pairs of forceps, the design of which he would explain at a later date (12). They had been designed in the winter of 1872/73, and were to be applied in the oblique and transverse positions respectively: 'Dr Vedeler, at the time the forceps were being designed, took a great interest in the idea and has since sought to gain experience of their practical application, which he has already commented on on several occasions'. However, a review of the proceedings up to the time of Sandborg's death in 1907 reveals no further mention of the forceps. It is also unclear why Sandborg wanted to present the forceps again, since Vedeler had already demonstrated them in 1874.

In 1906, Sandborg demonstrated the forceps to the newly appointed professor of gynaecology, Kristian Brandt (1859–1932), who became interested and accepted them as a gift to the Maternity Hospital, 'where they are now preserved and held in high regard' (13). Brandt believed they were 'far ahead of their time' and that Sandborg 'demonstrated a deep understanding of the mechanism of childbirth and exceptional mechanical skill'. Brandt noted that Sandborg himself had presented the forceps to the Norwegian Medical Society back in 1872 (14, vol. 4, p. 629), but without much interest from the audience and without the reference being officially recorded (13). Brandt attributed the lukewarm reception to the fact that the inventors were Norwegian – 'after all, they weren't from Edinburgh, London, Paris or Vienna'. Because of the lack of enthusiasm, Sandborg had set the forceps aside and turned his attention to other matters, until, the year before his death, he brought them out again. 'He

was pleased when I told him that I planned to demonstrate them to an expert audience at the Nordic Surgical Meeting here in the city this summer', wrote Brandt (13).

Brandt did not, however, become a spokesperson for the forceps. He was the dominant figure in Norwegian gynaecology, but he did not mention the Sandborg-Vedeler forceps in his textbook on obstetrics published four years later (15). Neither did he mention Kielland's forceps, despite them being used internationally (7). He believed that the Scottish obstetrician Simpson's forceps met all reasonable requirements and saw no need for alternatives (7).

The protocol from the university's obstetrics collection has been preserved, but it was discontinued in 1898, so the only reference to the 1906 donation we have is Brandt's letter. The protocol shows that there were already eight pairs of the Sandborg-Vedeler forceps in the collection – two different models – that had been 'found at a scrap dealer'. This collection is currently housed in the National Medical Museum at the Norwegian Museum of Science and Technology, and a search in the Digital Museum yields two results for the Sandborg-Vedeler forceps. They are listed as Sandborg-Vedeler forceps no. 2 (16) and no. 3 (17), both produced in 1874.

Who were Sandborg and Vedeler?

Christian Sandborg

Christian Peter Sandborg (1829–1907) was from Trøndelag and graduated with a degree in medicine in 1859. He worked as a practising doctor in Gjøvik and then in Norway's capital city from 1867 (14, vol. 4, p. 629). Sandborg had a strong interest in science, particularly physics and mechanics, and was described as a natural inventor (18) with a talent for mechanics and original ideas (19).

Sandborg's interests spanned many areas. In the 1860s, when the Norwegian Armed Forces were planning to introduce magazine rifles, proposals came from an officer, a gunsmith and from Sandborg, the city doctor (20, 21). His weapon has been described as well ahead of its time (22), and several of his magazine rifles are preserved at the Armed Forces Museum (23).

Some years later, Sandborg and physiology professor Jacob Worm-Müller (1834–89) developed an animal model that made it possible to study heart valves, and Sandborg proposed a theory on heart sounds (24, 25). This work was published in both German and French. In his later years, Sandborg developed a strong interest in electricity. There were likely few other city doctors with such a wide range of interests.

Berendt Vedeler

Berendt Christian Vedeler (1836–1909) was from Bergen. He graduated with a degree in medicine in 1862 and worked in his hometown for a few years before moving to the capital city where he maintained a busy practice as a specialist in

obstetrics and gynaecology (26). He was described as an energetic operative obstetrician with considerable technical skill (27).

He earned his doctorate in 1877, becoming the ninth medical doctor to qualify at the University of Kristiania. Among obstetricians, only Professors Faye and Schønberg had defended their theses before him. His most important published work was a textbook on gynaecology in 1875. He also published several shorter books and articles, but he was primarily known for his numerous contributions to professional debates (14, vol. 5, pp. 535–7).

The Norwegian Medical Society served as his primary forum (24), providing a platform for Vedeler to exercise his polemical skills and explore his broad range of interests. For many years, he engaged vigorously in debates that went far beyond his own specialty (19). His somewhat terse Bergen accent suited his often equally terse remarks (28). It was said that 'his hand was against everyone, and everyone's hand was against him' (29).

It is unclear how Vedeler and Sandborg joined forces or worked together. However, the medical community in Norway's capital city was small and easy to navigate, and the meetings of the Norwegian Medical Society provided a regular forum where colleagues with shared interests had ample opportunity to connect. Vedeler himself said, 'The idea, which I owe to Dr Sandborg and which I have carried forward with his help' (10, p. 54). The forceps were a collaborative project, with Sandborg cited as the lead, even though some have referred to them as Vedeler's forceps as he was the one who presented them in 1874 (4).

Recognition

The Sandborg-Vedeler forceps never achieved the same international recognition as Kielland's forceps – few ever did (7). Despite being just one of the many forceps designs developed and later abandoned, they are the only Norwegian-designed model to have made a notable impact.

Simpson's forceps have been the most commonly used in Norway from the 1870s to the present day (3). However, these were contraindicated when the foetal head was high in the pelvis with the sagittal suture positioned obliquely or transversely. Consequently, various forceps were developed to facilitate delivery regardless of the foetal head's orientation and its station within the pelvis. Such indications are now outdated, but at the time they posed a significant problem. When a high forceps delivery was not feasible, sometimes the only alternative was to dismember and remove the baby (2).

The Sandborg-Vedeler forceps were designed to achieve a biparietal grip on the foetal head when it was high in the pelvis in a transverse or oblique position (10). Because it was difficult to apply the anterior blade in such positions, this blade was significantly shorter than the posterior one, which was easier to position. However, this design made the extraction of the foetal head more challenging. Multiple variants of the forceps were developed, with one goal

being to secure a biparietal grip when the sagittal suture was aligned with the oblique diameter, and different application techniques were required depending on whether the foetal head was in the right or left oblique lie.

A contemporary of the forceps designers, Professor Edvard Schønberg (1831–1905), who was one of Vedeler's frequent discussion partners in the Norwegian Medical Society, presented the forceps in his 1899 textbook on practical obstetrics (30, p. 32). Schønberg wrote that although the forceps were applied obliquely, the handles aligned in the frontal plane due to a slight twist in the locking mechanism. The forceps came in a matching set, with one pair designed for the right oblique diameter and the other for the left.

In the Science Museum

In his impressive work on obstetric instruments, the British gynaecologist Bryan M. Hibbard reproduced photographs of three different Sandborg-Vedeler forceps from the Science Museum in London (8, p. 132). We were unaware that the forceps were held there until we read about it in Hibbard's book (31).

A search on the Science Museum's website yields three hits for Sandborg-Vedeler (Figure 1, Figure 2) (32–34). In addition, there is a fourth pair of forceps, which lack further identification (35). The website states that two of the forceps were purchased from a private collector in Oslo in September 1929, but it transpires that this is incorrect. The museum holds a letter from Professor Brandt dated 22 September 1929 (36) (Figure 3), in which he wrote that during the cancer congress in London the year before, he had the pleasure of visiting the museum: 'For supply of your exhibition of obstetrical forceps, I think some forceps of Norwegian construction and make will interest you. The constructors are Dr Sandborg and Dr Vedeler'. Brandt noted that the forceps had been made for use on the head above the pelvic inlet, but that they had never been used, 'as we here only use forceps in typical cases'. The archives include two letters of thanks from L.W.G. Malcolm, who was curator of the Wellcome Historical Medical Museum from 1925 to 1934.

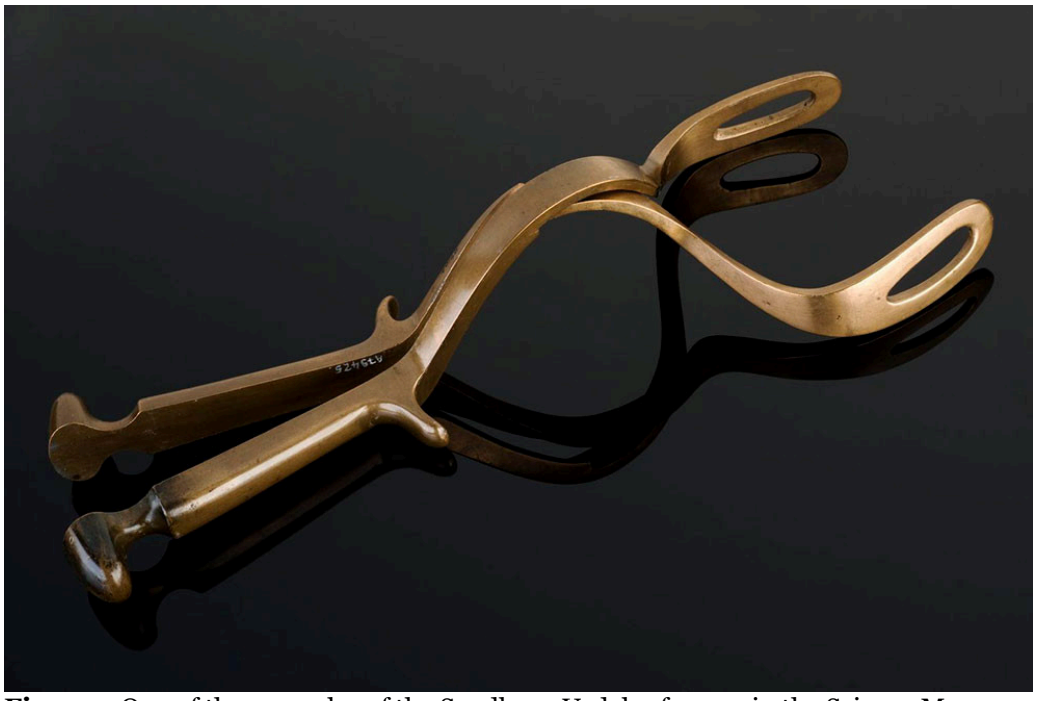


Figure 1 One of the examples of the Sandborg-Vedeler forceps in the Science Museum, London (32). CC BY-NC-SA 4.0.

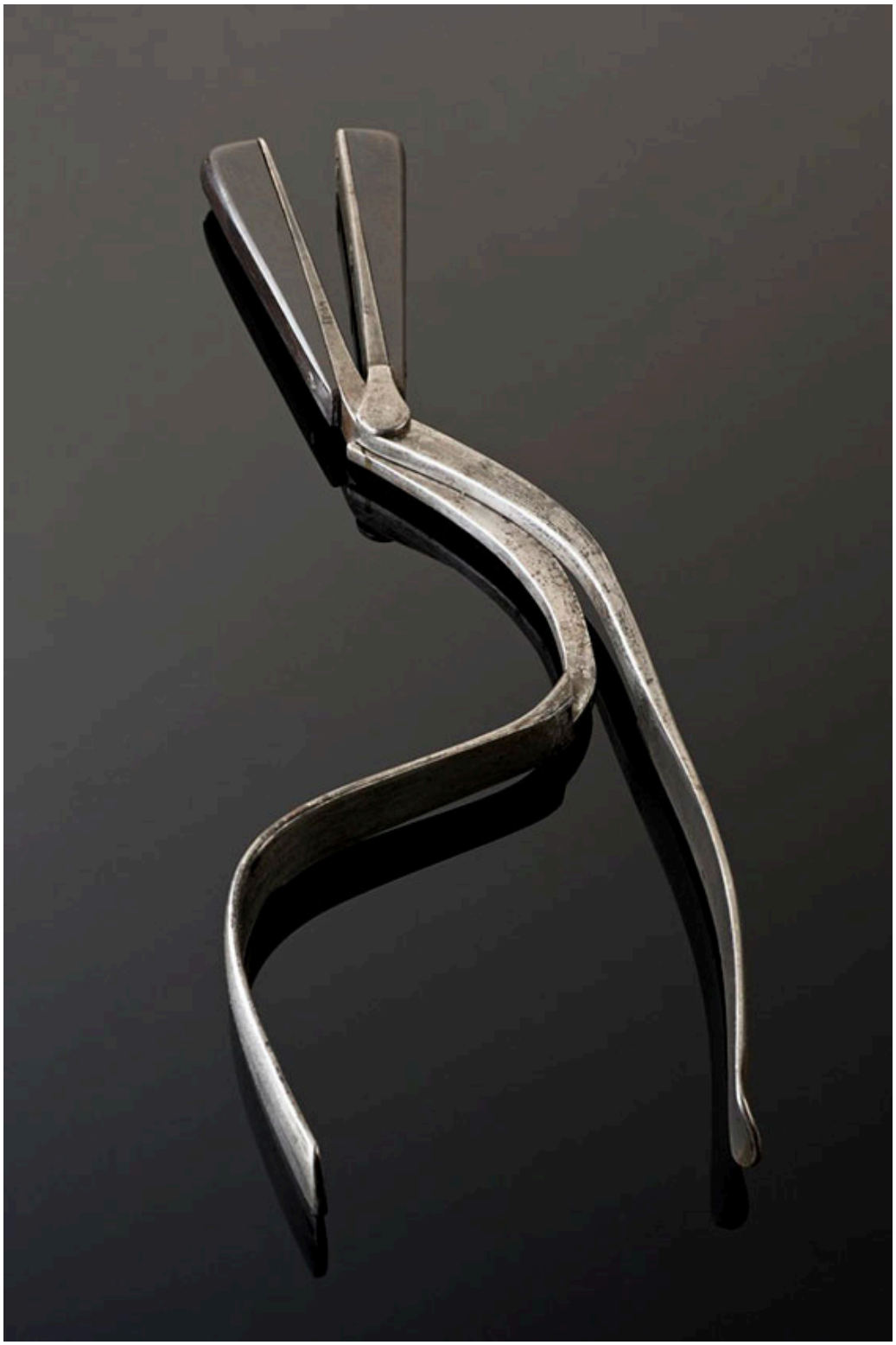
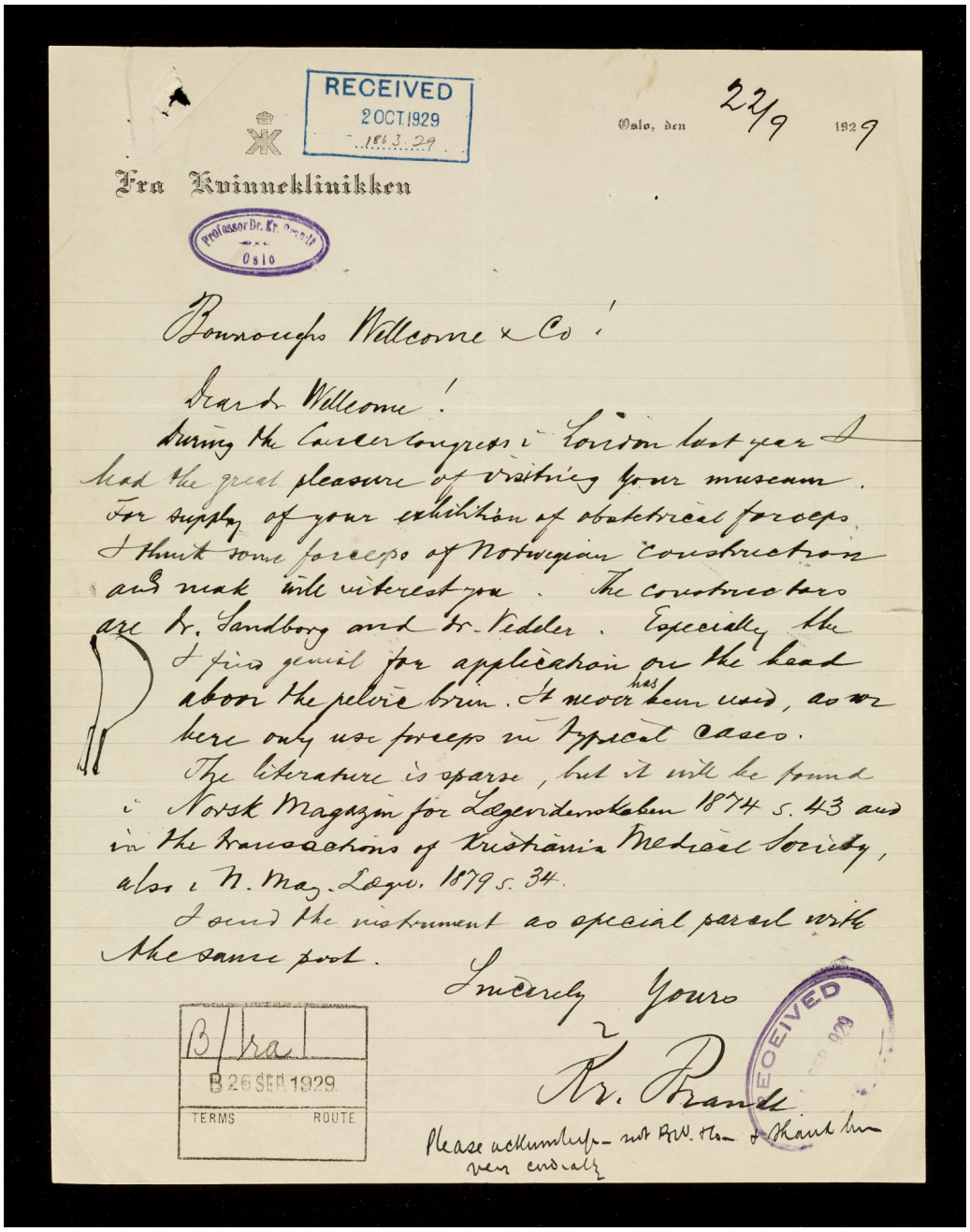


Figure 2 Another of the examples of the Sandborg-Vedeler forceps in the Science Museum, London (33). CC BY-NC-SA 4.0.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20 OCT 1929
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Oslo, den 22/9 1929

Fra Kvinneklinikken

Professor Dr. Kr. Brandt
Oslo

Burroughs Wellcome & Co.!

Dear Sir Wellcome!

During the Cancer Congress i London last year I had the great pleasure of visiting your museum. For supply of your exhibition of obstetrical forceps I think some forceps of Norwegian construction and make will interest you. The constructors are Dr. Sandborg and Dr. Vedeler. Especially the first is genial for application on the head above the pelvic brim. It never has been used, as we here only use forceps in typical cases.

The literature is sparse, but it will be found i Norsk Magazin for Lægevidenskaben 1874 s. 43 and in the Transactions of Christiania Medical Society, also i N. Mag. Lægev. 1879 s. 34.

I send the instrument as special parcel with the same post.

Sincerely Yours

Kr. Brandt

Please acknowledge – not RW. Hsn – & thank him very cordially

B/Bra
B 26 SEP 1929
TERMS ROUTE

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Figure 3 The letter from Professor Brandt dated 22 September 1929 accompanying the donation of the Sandborg-Vedeler forceps (36). Photo: 'Bradbury-Bryan'/Wellcome Collection

Brandt donated six pairs of forceps, but only four have been preserved in the Wellcome Historical Medical Museum, which later became part of the Science Museum. The whereabouts of the remaining two pairs of forceps are unknown (Selina Hurley, Curator of Medicine, Science Museum, personal communication, 27 July 2021).

Brandt sent the forceps to London in September 1929. He was due to retire that year and wanted to arrange this while there was still time. He likely regarded the Sandborg-Vedeler forceps as a particularly notable Norwegian contribution, as he wrote in 1907, describing them as well ahead of their time and reflecting a deep understanding of the mechanism of childbirth and exceptional mechanical skill.

It is not easy in retrospect to determine why the Sandborg-Vedeler forceps never became a success. Brandt pointed out that the inventors were Norwegian, but this argument does not hold given that Kielland became world-famous for his forceps just a few decades later. One difference was that Kielland presented his forceps internationally, whereas Sandborg and Vedeler did not (7). Both of their published works are technical and difficult to understand today (10, 37). The Sandborg-Vedeler forceps required significant skill on the part of the obstetrician, but the same criticism was also levelled at Kielland's forceps (7). Sandborg and Vedeler were not part of the academic community in Norway's capital city – but neither was Kielland (7). Kielland reached his professional audience primarily through the German medical community (7). The dominant figure in Norwegian obstetrics, Professor Kristian Brandt, was apparently enthusiastic about the Sandborg-Vedeler forceps but not Kielland's forceps (7). Whether this was due to the instruments themselves or their inventors is unknown. Ultimately, it is also difficult to assess how innovative the Sandborg-Vedeler forceps actually were. When Vedeler presented them in 1874, there were already 300 forceps designs in existence (10); fifty years later, that figure had doubled (4). New forceps models were constantly emerging and disappearing. In any case, the practical application of the Sandborg-Vedeler forceps would not have had a long lifespan. The era of high forceps deliveries was coming to an end, but the story illustrates the challenges posed by complex forceps designs in the years before caesarean section replaced the most intricate forceps deliveries.

The article has been peer-reviewed.

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Publisert: 25 June 2025. Tidsskr Nor Legeforen. DOI: 10.4045/tidsskr.25.0022
Received 12.1.2025, first revision submitted 17.4.2025, accepted 27.5.2025.