Prof. Dr. Techn Max Kurrein

(1878 - 1967)

After Schlesinger, Max Kurrein held the chair for machine tools and production plants. He is one of the most important industrial engineers of the Technical College in Berlin. His areas of research and teaching included industrial and military work, working and measuring tools, material testing and precision mechanics manufacturing[1]. Max Kurrein, as an outstanding man of science, was - in much the same way as Georg Schlesinger - subject to national-socialist agitation even prior to their obtaining power in 1933. The NSDAP[2] attempted to wield its influence as early as 1932 in the Prussian Ministry of Education and Cultural Affairs in order to oust Kurrein from his post at the Technical College. In mid 1933 the NSDAP raised an interpellation at the Prussian Parliament, in which the ”Jewish Professor Kurrein” was accused to have, as part of his duty as a consultant to the highest German court, the Reichsgericht, decided against his better judgement in favour of the American Gilette company. His sacking from the technical college followed in the summer of 1933. He successfully emigrated to the Palestine in 1934 after police had held him temporarily in ”protective custody”. His emigration was a result of the Hebrew Technion in Haifa appointing him to set up an industrial engineering faculty. The technical education which he accomplished at the new faculty is comparable to the achievements of Redtenbacher, Zeuner, Karmarsch, Bach, Riedler, Schlesinger and others at German colleges.

Max Kurrein was born on 29 April 1878 in Linz, Upper Austria. His academic parents, Adolf and Jessie Kurrein, belonged to the haute bourgeoisie. His mother, Jessie Kurrein (born 1849 in Broadstairs, England, deceased 1934 in Vienna), née Loewe, was the daughter of the orientalist and diplomat Dr. Louis Loewe (born 1809 in Suelz, deceased 1889 in London)[3]. Loewe had studied in Vienna and Berlin prior to moving to London in 1833. He undertook many journeys to Egypt and dedicated himself to the deciphering of inscriptions in Theben, Alexandria and Cairo. At the same time he studied oriental languages, amongst them Persian, Turkish, Caucasian and Nubian as part of his archaeological numismatic investigations. As expert and translator he finally became personal secretary to Sir Moses Montefiori in

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[1] Note: Max Kurrein's life has been examined exclusively from the point of view of the development of the chair for machine tools and factories of the Technical College Berlin. At the same time the authors believe that questions have been raised, especially in connection with Kurrein's activities in Haifa, which ought to be addressed by, perhaps, a joint German-Israeli research project.

[2] Translator's note: National Socialist German Workers Party (Nationalsozialistische deutsche Arbeiterpartei)

[3] See Strauss, H.A.; Röder, W. (ed.): Int. Biographical Dictionary of Central European Emigrés 1933-1945. Vol. II/Part 1, The Arts, Science, and Literature. München, New York, London, Paris: K.G. Saur 1983, Entry: "Kurrein, Max".

Damascus[4]. Louis Loewe held the post of director of the oriental department of the Duke of Sussex' library from 1839 to 1856 and was vice-chancellor of the Jew's College in London from 1856 to 1858[5].

Max Kurrein's father was the chief Rabbi of Linz, Dr. Phil. Adolf Kurrein, soon to become chief Rabbi of Teplitz. Adolf Kurrein (born 1848 in Trebitsch, Moravia, deceased 1919 in Teplitz), had studied history, indo-Germanic languages and mathematics at the University of Vienna and had the doctor's degree conferred upon him in 1871. After he had attained his Rabbi diploma in 1872 he became Rabbi in St. Pölten. In the following year the family moved to Linz, where Max, the first of five children, was born[6]. In 1881 they moved to Teplitz/Schönau. Adolf Kurrein published numerous papers on the Jewish situation, actively supported Theodor Herzl's plans and was delegate of the first Zionistic congress[7].

After their son Max completed his studies at the humanistic grammar school in Teplitz with distinction he went to the German technical college in Prague to study engineering science in 1896. At the young age of 22, in the year 1900, he became a fully fledged engineer. In addition to his assistantship at the University of Brünn, he completed his PhD at the University of Prague in 1904 to become a doctor of "technical science"[8]. The subject of his PhD, "Structural Changes in Ingot Steel under Mechanical Stress"[9], was a precursor to one of his main research subjects later on: mechanical metallurgy and metallography. He lived in Birmingham, England, from 1905 to 1909, where he worked as technical and chief designer for W.T. Avery. In the following two years he worked in Düsseldorf as chief engineer in an experimental department for machine tools[10]. In 1911 he moved to Berlin and became permanent

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[4] In this capacity he was also involved in the "Damascus affair" of 1840, where, as a result of the murder of an Italian priest and his Muslim servant, Jews were incarcerated and acts of revenge were perpetrated. Because of the arrest of an Austrian citizen the affair attained the status of a local diplomatic conflict, in which representatives from France, England, Austro-Hungary and the United States became involved. Together with James de Rothschild, Montefiore and others, Loewe managed to have the prisoners released as part of an initiative of prominent Jews to the Egyptian ruler Mohammed Ali Pascha. On top of that he supported Montefiori (1784-1885) during the first negotiations with the Turkish sultan in 1840, during which they obtained guarantees for the Jews living in the Ottoman Empire. Montefiore descended from an old Italian merchant family and became rich early in life while speculating on the London stock exchange. He is regarded as a philanthropist and fought for Jewish rights in the whole of Europe as well as the Arab world - according to: A highly important silver candelabra, Auction catalogue, Documents Ina Dimon. Spur Collection, Encyclopaedia Britannica 1999.

[5] A highly important silver candelabra, Auction catalogue, Documents in Dimon, Spur Collection.

[6] Max Kurrein's siblings were: Dr. Med. Isidor Kurrein, born 1879, died 1943 in KZ Auschwitz; Dr. Phil. Rabbi Victor Kurrein, born 1881, died in Ramsgate, UK, 1954; Dr. Chem. Herbert Kurrein, born 1882, died in Haifa 1954; Elisabeth Lichtenstein, née Kurrein, born 1885, died 1943 in KZ Auschwitz - Strauss, H.A.; Röder, W. (Ed.): Int. Biographical Dictionary of Central European Emigrés 1933-1945. Vol. II/Part 1, The Arts, Science, and Literature. München, New York, London, Paris: K.G. Saur 1983, Entry: "Kurrein, Max".

[7] Biographical note: "Vater von Max Kurrein" (translator's note "Father of Max Kurrein") by Ina Dimon; Int. Biographical Dictionary

[8] compare Heymann 1968: 1.

[9] German original: "Gefügeänderungen in Flußeisen unter mechanischer Beanspruchung"

[10] Int. Biographical Dictionary

assistant at the Technical College in Charlottenburg. In the academic year 1913/14 he was appointed engineer at the experimental chair for machine tools and factories and it was not before long that he became their chief engineer.

Max Kurrein's name is closely linked with the history of experimenting with machine tools. This area experienced a specially active period prior to the first world war. In 1912 Schlesinger had the facilities improved and enhanced the technical equipment. Moreover, he had Kurrein working together with Otto Rambuschek, who had been chief construction engineer of the experimental department since 1906. Kurrein habilitated in 1913, which enabled him to become a lecturer from the following winter semester onward. Georg Schlesinger, whose assistant he was and whose colleague Kurrein would become, supervised his habilitation very closely. Kurrein's study of "Areas of Usage of Measuring Devices in General Manufacturing"[11] earned him his teaching license. In the academic year 1913/14 Kurrein held a one hour long lecture on "Production and Testing of Measuring Equipment and Measuring Tools"[12].

The war brought about a break in Kurrein's career. During the entire period of the war Otto Rambuschek remained chief construction engineer in the experimental department. Max Kurrein, on the other hand, soon received his military call up[13]. Following his voluntary enlistment as a so called "Non-server"[14], he was assigned to the Austro-Hungarian army[15]. As first lieutenant and engineer he ran the canon factory of the Vienna arsenal until Christmas 1918[16]. It was only in the beginning of 1919 that he went back to his work as a chief engineer and once again took up his teaching duties. During the war he had been substituted by Eugen Rehner and from the summer semester 1917 onwards by Eugen Simon[17]. In 1921 Rambuschek left the chair for machine tools and factories. Kurrein became his successor as chief construction engineer and was to run, having been given the title of reader in 1922, the experimental field until his removal by the National Socialists in 1933.

In 1918 Max Kurrein married Charlotte Blau (born 1894), who belonged to a respectable merchant family from Berlin, which also prided itself on having a number of famous medical specialists in its midst. Her father was the privy councillor Dr. Louis Blau, who had studied, amongst others, under Du Bois, Reichert and Virchow.

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[11] German original: "Verwendungsbereich der Meßdosen in der allgemeinen Fabrikation"
[12] German original: "Die Herstellung und Prüfung der Meßmaschinen und Meßwerkzeuge"
[13] Compare: Kurrein's letter to the Minister of Education, dated 8 March 1919 (GStAPK, I. Ha, Rep. 76, Vb, Sekt.4, Tit. III,, Nr. 8, Bd XII)
[14] German original "Nichtgedienter" - translator's note: somebody, who has not had previous experience in the military.
[15] Compare: Kurrein's letter to the Minister of Education, dated 8 March 1919 (GStAPK, I. Ha, Rep. 76, Vb, Sekt.4, Tit. III,, Nr. 8, Bd XII)
[16] Compare: Tetzlaff 2000. Kurzbiographien bedeutender deutscher Juden des 20. Jahrhunderts (translator's note: Short biographies of important German Jews of the 20th Century), Lindhorst, (Askania) 1982, 189.
[17] TH Programm (Translator's note: Programme of the Technical College) pp.1915/16

Blau was a consultant and an ear specialist and edited the ”Ontological Review”[18] from 1910 until his death in 1919. Charlotte studied mathematics and physics at the University of Berlin. One of her tutors was Max Planck[19]. Of Max’ and Charlotte’s two children the first, Fritz Georg, called Fred, was born in the same year that they married, namely 1918. Their daughter Ina was born in 1922. In 1924 Kurrein became an honorary member of the Prague Society in Support of Israeli engineers[20].

Prior to the first world war, Max Kurrein’s inclusion on the Technical College staff meant a widening of the scope of subjects. Kurrein took over ”Exercises in the Experimental Field” in the academic year 1912/1913, which was new in the syllabus. Moreover, he held his one hour lecture on ”Production and Testing of Measuring Equipment and Measuring Tools” in the academic year 1913/1914. Following his return to teaching in 1918 he continued giving these lectures in a nearly unaltered form until 1920/1921, not receiving any remuneration for his work. From 1919/1920 he expanded his teaching repertoire with another one hour lecture on ”Tools for Machine Fabrication”. Both lectures were known under the heading ”Working and Measuring Tools” until 1922/23 and were combined thereafter, which resulted in a two hour weekly lecture known as ”Working and Measuring Tools for Machine Production, Their Production and Testing”.

Name	Year	Status	Thesis Title	Referents
Hänsel, Fritz	1.1.1925	external	Testing of Pneumatic Hammers	Schlesinger, Kurrein
Roszavölgyi, Laszlo	12.9.1928	external	Recording of Performance and Pay with Special Regard to the Pay-Office	Schlesinger, Kurrein
Guttman, Erich	15.4.1932	external	Testing the Working of Hard Brass while Examining a New Procedure for Measuring Cutting Pressure Electrically	Schlesinger, Kurrein, Orlich
Lingemann, Emil	25.05.1932	Assistant (not paid)	Prerequisites for Economic Turning and Drilling of Electron.	Schlesinger, Kurrein, Hanner
Seifert, Artur	20.07.1932	external	Fittings for V-Profiles in Automobile and Machine Tool Production, Diss.	Hanner, Kurrein

[18] German original: ”Ontologische Rundschau”

[19] Compare book of enrolment of student phil. Charlotte Blau, Königliche Friedrichs-Wilhelms-Universität Berlin, no. 3359 in the register, 15th April 1914, documents Ina Dimon. The book contains entries up to February 1918. After that Charlotte Blau attended lectures mostly by Professors Planck and Knopp.

[20] Fritz Georg Kurrein, called Fred (1918-1992), was a fighter pilot for the RAF during the second world war. After the war he worked for the English Metal Powder Co. together with his father’s former graduate Heinz Meyersberg (see entry ”Meyersberg”). The daughter, Ina Dimon, née Kurrein, lives in Haifa.

			20.07.1932	

Max Kurrein's doctoral candidates while he held the chair for machine tools and factories.

Max Kurrein's name last appeared in the university calendar of 1932/33. Until then he gave the "Working and Measuring Tools" lecture series during the winter semesters, the "Operational Studies" lectures during the summer semesters and the "Fine-Mechanical Production" series of lectures including the three hourly practical sessions throughout. Unlike Schlesinger's lectures, Kurrein's were struck off the university calendar from 1933/34 onwards without being replaced (figure 12-03).

During the academic years from 1924/25 until 1928/29 Kurrein limited his "Working and Measuring Tools" lectures to winter semesters only and replaced these with "Operational Studies" lectures of equal length (2 hours per week) in the summer semesters. In the academic year 1926/27 he took on another series of lectures (again, two hours per week) on "Fine-Mechanical Production". It is clear from correspondence between the faculty for machine tools and the ministry of science, art and education, that the faculty decided to include these lectures in their syllabus on 14th April 1926 in order to better meet the requirements the precision engineering industry made on its workforce[21]. It appears that Kurrein held these lectures, which were extended by a further three hours of practical exercises, of his own free will. Various requests to furnish him with a teaching assignment (22.3.1928), a lectureship (30.6.1928) or even to create a permanent professorship for precision engineering (1929) were declined.

In their report, drafted in 1924, Kurrein and Schlesinger summarised the improvements made to the facilities to the experimental machine tool department at the Technical College from 1912 onwards. They stated, that the facilities had been systematically enhanced to make a complete industrial engineering examination of the following areas possible:

- Machine tools in both fiscal as well as operational contexts
- Work and measuring tools in terms of quality of work, material, exactness, in both normal and stressful conditions with or without control measurements
- Working materials such as belts, lubricants, coolants, hardeners, etc.
- Working processes on raw materials and intermediate stages

Articles published by Kurrein between 1914 and 1917 give a rough overview of research done during the war. Amongst others they dealt with "Production of Rifle Ammunition", "Typical Products of Rifle Production" and "Modern Machine Tools and

[21] Compare a letter by the faculty of machine tools' dean to the minister for science, art and education from 22nd March 1928, GStAPK I. HA, Rep 76, V b, Sekt. 5, Tit. III, Dpt. III, no. 5C, Vol I, Bl. 234-238

the War Effort"[22]. Apart from their obvious contribution to weapon and ammunition production, these articles prove the teamwork between the institute and its members and the military planning bureaus in general and the Spandauer Rifle Factory in particular. Kurrein's efforts in this field would have been virtually impossible to achieve without Schlesinger's consent and support. This in turn suggests that Schlesinger did not only put himself, but the whole institute, including its competencies, logistics and infrastructure at the disposal of the war effort. In the same period Max Kurrein, together with Schlesinger, published the essay "Research and Factory. Lubricant Testing within the Company" (Werkstattstechnik[23] 1916, Vol. 10) and put to print a number of articles, which document the need for special research projects during war and clearly reflect his interest in measuring techniques - a subject which was to become the main focus of his later research[24].

Out of the 572 articles published in the "Werkstattstechnik" by Schlesinger and his colleagues during 1918 and 1933, circa 170 were penned by Kurrein. This means that he was as productive as Schlesinger himself. Between 1918 and 1924 Schlesinger and Kurrein published four monographs along with numerous articles in "Werkstattstechnik" about production techniques and machine tools.

In 1920 Schlesinger and Kurrein published results from tests on replacement belts made in the experimental department, which built on initial examinations dating back to 1918[25]. Aim of this research was to establish criteria enabling the setting of quality standards for the various replacement belts, which appeared on the market during the war[26]. Research was continued after 1920 in order to "assess the number of inconsistencies made apparent by previous tests, and to establish the impact of stress prior to and during operation[27]". The sixth booklet with reports by the experimental department for machine tools appeared in 1924 with the title "Replacement Materials" ("After Effects of War"). It contains articles by Schlesinger, Kurrein and Simon on their tests of replacement belts, drilling oils and low grade copper zinc alloys for use in bearings[28].

[22] Kurrein, M.: "Die Herstellung der Gewehrpatronen – Production of Rifle Ammunition". In: Technische Rundschau, no.20 Vol 51, 1914, pp.517; Kurrein, M.: "Die Herstellung der Patronenhülsen und Patronen – Cartridge Case and Ammunition Production". In: Zeitschrift für das gesamte Schieß- und Sprengstoffwesen.10 (1915) pp.61; "Typische Arbeiten aus der Gewehrfabrikation – Typical Products of Rifle Production". In: Technische Rundschau, No.21, Vol.11, 1915, pp.69; "Moderne Werkzeugmaschinen und Kriegsarbeit – Modern Machine Tools and the War Effort". In: Technische Rundschau,, no.23, Vol.16, 1917, pp.113.

[23] Translator's note: German engineering publication

[24] Compare Max Kurrein's list of publications.

[25] Georg Schlesinger/Max Kurrein, Untersuchung an Ersatzriemen – Testing Replacement Belts. Mitteilungen des Versuchsfeldes für Werkzeugmaschinen an der Technischen Hochschule Berlin, In "Werkstattstechnik XIV", 1920, 385-388 and 420-426.

[26] see footnote 23, p.385

[27] see footnote 23, p.420

[28] Georg Schlesinger/Max Kurrein/Eugen Simon, Forschung und Werkstatt II. Ersatzstoffe ("Kriegsnachklänge"). 1. Untersuchung von Ersatzriemen – Testing Replacement Belts; 2. Untersuchung von Bohrölen – Testing Drilling Oils; 3. Kupferarme Zinklegierung für die Lagerung der Werkzeugmaschinen. Einfluss der Gießart und der Schmierung – Low Grade Copper Zinc Alloys for

Questions relating to standardisation and measuring techniques were closely interlinked, and dealt with mainly by Max Kurrein. Measuring techniques were his main focus up to 1924 and he published nearly 20 articles as well as a volume in the Werkstattbücher[29] series in 1921, the second edition of which appeared in 1923. Schlesinger himself only published two articles on this subject, both in 1920.

Amongst the numerous articles about new measuring tools, Kurrein published a special edition in the ”Werkstattstechnik” series in 1919 about ”Measuring Tools and Techniques”[30]. He pointed out that prior to the war Germany had been one of the world leaders in the area of measuring techniques and stressed the close connection to standardisation. The results of the ”enormous workload absolved during the years of the war” were the foundation for the effectiveness of the various standardisation committees. Only ”the sheer abundance of accumulated material” made it possible to do some groundwork on fitting systems, thread measurements, gauges and types at a given temperature. Standardisation on the basis of advanced measuring techniques was, according to Kurrein, a prerequisite for ”functional production”:

> That the soul of an orderly and modern factory is a skilful and in every aspect properly functioning tool fabrication process and that this is therefore the area one has to look at most and foremost if one aims to achieve a true and enduring factory improvement, is common knowledge among bigger and well run plants and factories, but mostly ignored by many smaller companies (...) Perhaps the most important aspect of tool fabrication is the measuring and quality control of the tools during fabrication prior to their storage; if suitable storage is possible, one can expect properly functioning tools from the tool makers. Moreover, if faults in the production process can be identified prior to delivery to the factory, one can take responsibility for the skilful production of tools[31].

In 1921 Kurrein’s article entitled ”Measuring Techniques”[32] appeared as second booklet in the Werkstattbücher series, edited by Eugen Simon. Already in 1913 the Julius Springer publishing house created the Werkstattbücher series from existing factory handbooks. However, these were only published by Simon as an improved version after the war[33]. The book on measuring techniques dealt with ”the necessary in a clear and detailed manner”[34]. It described in detail the most important measuring

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Machine Tool Bearings. Impact of Casting Procedure and Lubrication (Berichte des Versuchsfeldes für Werkzeugmachinen an der Technischen Hochschule Berlin 6), Berlin 1924

[29] Translator's note: literally translated: workshop books

[30] Kurrein, Messgeräte und Messverfahren, Werkstattstechnik, II. Sonderheft, November 1919, p.24

[31] Kurrein, Messgeräte und Messverfahren, Werkstattstechnik, II. Sonderheft, November 1919, p.7

[32] German original: ”Meßtechnik”

[33] Werkstattbücher für Betriebsbeamte, Vor- und Facharbeiter. Editor: Dipl. Eng. Eugen Simon, Berlin. Julius Springer, Berlin 1921. Booklet 2. Measuring Techniques. By Priv.-Doz. Dr. techn. Max Kurrein

[34] Book review, Werkstatttechnik 16 (1922) Vol.2, p.57

tools and techniques, which the relevant industries had poured onto the market. This list of all available products was supposed to assist specialists in the machine tool field in making informed decisions. In addition some newly developed tools were presented,

> "... which were partly designed according to the factory's own needs, but already existing designs were also adapted and developed further in accordance with in-house requirements. The author considered it proper to include such designs and techniques in the booklet, as they represent likely developments when normal tools are not available or do not meet requirements[35]."

Shortly before and during the period mentioned above, Max Kurrein published some short articles about special turning tools in "Werkstattstechnik", which may have been inspired by his supervising Klopstock's PhD. The longest of these articles deals with thread cutting on a lathe. In it he discusses systematically and in context the required prerequisites for using a lathe for cutting threads, the adjustment of tools, the cutting of multiple and conical threads etc. Kurrein did not fail to mention the necessary measuring tool, a micrometer for measuring threads[36].

The work on drills was part of the systematic research in the field of necessary machine tools and production, all of which were part of the overall research of the experimental department. Their aim was to optimise construction and precision under factory conditions. Schlesinger's monograph about "The Drill, its Construction and Use"[37] from 1925 summarised the results of the previous years. Kurrein's articles on screw taps stemmed from this work and appeared in the same year in the "Werkstattstechnik". They were supposed to give an insight into the exactness of measurement achieved during drilling[38]. The differences observed between threads worked by normal screw taps and those which worked without fault – in exactly the same conditions – could only "be accounted for by the screw tap construction. They became much more obvious when typical[39] and differences in construction of the drill come into force"[40].

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[35] Compare Kurrein, Messgeräte und Messverfahren. Werkstattstechnik, II. extra edition, November 1919, p.1

[36] compare Max Kurrein, Gewindeschneiden auf der Drehbank – Cutting Threads with a Lathe, in: Werkstattstechnik XIV, 1920, 117-120 and 151-154; Max Kurrein, Mikrometer für Gewindemessungen, in: Werkstattstechnik XIV, p. 120

[37] German original: "Die Bohrmaschine, ihre Konstruktion und ihre Anwendung"

[38] M[ax] Kurrein, Die Prüfung der Gewindebohrer – Testing Thread Drills. Mitteilungen aus dem Versuchsfeld für Werkzeugmaschinen, in: Werkstattstechnik XIX, 1925, 601-619

[39] Translator's note: There is a word missing in the original German transcript, resulting, unfortunately, in a meaningless sentence.

[40] M[ax] Kurrein, Die Prüfung der Gewindebohrer – Testing Thread Drills. Mitteilungen aus dem Versuchsfeld für Werkzeugmaschinen, in: Werkstattstechnik XIX, 1925, 603

Customary screw tap quality control was therefore of no significance when it came to ”the work itself”. Customary ¾”-Whitworth screw tap sets as well as ¾” female screw taps were used in the tests. Four sets produced by ”the best German companies” were used on ingot steel, cast iron, two kinds of brass and two different aluminium alloys from both Germany and America.

During the material convention in Berlin in 1927, both Kurrein and Schlesinger, as part of the ”Material Working Group”, held talks on this subject, which, together with contributions by other members of the group – Vogelsang, Peter and Kühner – were to be published in volume 21 of ”Werkstattstechnik”. Schlesinger lectured on ”Working of Materials. Interaction between Material and Tool”[41] and provided an insight into the workings of the experimental department[42].

Max Kurrein, taking up where Schlesinger had left off, went into the subject in more detail in his study entitled ”Working of Metals in Connection with Strength Testing” and suggested a law of deformation taking into account results of material testing and forces set free during cutting:

> Deformation taking place during cutting is defined by processes between cutting blade or bit and the material, namely cutting pressure and the facings. The former determines calculations relating to the whole process, the cut material represents the factory intended deformation and the subsequent increase in value. It is therefore imperative, that, after having stated the working process, the strength of the material to be worked, the working conditions and the form of the tool, one can determine the magnitude of the necessary forces.[43]

All technical strength calculations, according to Kurrein, were subject to two prerequisites, namely the theoretical stress formula and the stress value of the material to be used. The ”strict application of the theoretical formula to the actual stress” applied to a component – ”in praxis an impossibility” – was adjusted by a ”degree of security”. The estimate of the ”degree of security” was subject to mere experience. The negative impact of this method showed up especially during the production or purchase of the machine tools and just as often during the pricing for such a method of production. These figures, called ”material constants”, were, as a rule ”very questionable” and subject to great variations, in order to ”cover our ignorance of deformation theory in its practical application”[44].

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[41] German original: ”Bearbeitbarkeit. Wechselwirkung zwischen Werkstoff und Werkzeug”
[42] G[eorg] Schlesinger, Bearbeitbarkeit. Wechselwirkung zwischen Werkstoff und Werkzeug, in: Werkstattstechnik XXI, 1927, 605-612
[43] G[eorg] Schlesinger, Bearbeitbarkeit. Wechselwirkung zwischen Werkstoff und Werkzeug, in: Werkstattstechnik XXI, 1927, 605-612
[44] G[eorg] Schlesinger, Bearbeitbarkeit. Wechselwirkung zwischen Werkstoff und Werkzeug, in: Werkstattstechnik XXI, 1927, 612

Kurrein, based on Nicolson's research and supported by microscopic observations, put forward the thesis that one law should govern all kinds of cutting – planing, turning, drilling and milling. This law could be formulated once the mechanical laws between yield point and breaking point of metals were sufficiently known. For the time being one was reduced to the deductive method of determining such forces by measuring them under known conditions for different materials and different tools etc. and thus postulate a possible relationship between material strength and cutting forces. Only practical examinations and measuring equipment of the experimental department at the Technical College Berlin made it possible to measure such forces "exactly and properly" and thus determine the parameters needed to define the governing law for these forces. Klopstock was the first to establish the relationship in relation to turning, but it was Kurrein, who expanded it to drilling and grinding and made exemplary calculations:

> Following these results, which have to be verified during further tests on different materials, the validity of a common law, which can be applied to mechanical production and which governs the relationship between material strength and cutting forces for all cutting procedures, can be said to have been almost achieved[45].

In 1928 Kurrein published his test results on grinders[46]. The tests were understood to be a continuation of the work on the measurement of grinding forces dating back to 1925[47], which served the development of grinders and are related to the production side of the relationship between material workability and material testing. The aim was to achieve a dependable numerical value of the hardness of the disk by way of objective criteria. As a result five different disks with the same grain size, but with different hardness values were chosen. Siemens-Martin steel of 65kg/mm^2 of the same dimension as during the first test was used for grinding. The disks' make-up was, apart from the raw materials used, defined by hardness and grain size. While the latter was a value which, through the production process and careful riddling, could be depended upon, the former was subject to great variations due to a lack of standardisation.

Kurrein deduced from the test results that a classification of the disks according to their hardness would be possible, which would be "devoid of individual guesswork and therefore much more accurate than has been possible with current techniques"[48].

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[45] G[eorg] Schlesinger, Bearbeitbarkeit. Wechselwirkung zwischen Werkstoff und Werkzeug, in: Werkstattstechnik XXI, 1927, 621

[46] M[ax] Kurrein, Untersuchung der Schleifscheibenhärte – Testing Grinding Disk Hardness, in: Werkstattstechnik, XXII, 1928, 293-298

[47] M[ax] Kurrien, Innenmessung – Inside Measurement, in: Werkstattstechnik XIX, 1925, 493

[48] M[ax] Kurrien, Innenmessung, in: Werkstattstechnik XIX, 1925, 298

He suggested to put up tables for standardised steels or, alternatively, to determine a standard steel as testing material.

In 1929 Kurrein conducted experiments with milling processes in a similar vain. His aim was to prove the laws which he set up for other working processes for the mill. During his experiments Kurrein formulated a number of construction principles for the production of mills[49].

He determined a number of basic principles and described the necessary machinery and processes to make accurate and successful testing possible. The tests were thus comprised of the following

- the material to be worked, i.e.
  testing of mechanical properties of the material to be worked,
  internal structure of the material to be worked,
  workability of the material to be worked,
  special properties for certain purposes as well as
- the material used to work the piece, i.e.
  testing the material for the tools,
  testing the tools,
  testing the coolants,
  testing abrasion from A and B[50].

The article on ”Machinery to Determine Hardness” provides an overview of the different techniques and machines used in the process. This article builds on the studies of the workability of metals, which were undertaken at the department between 1925 and 1929. A precise definition of the term ”hardness” was still under dispute, which led Kurrein to once again draw attention to the problems arising from the multitude of different measuring techniques. Because it was only possible to ascertain a relationship between results of the different measuring techniques by conducting thorough comparable tests it was necessary, prior to the acquisition of a new tool/machine, to

- determine the suitable testing procedure
- determine the appropriate measurement of forces according to one’s needs
- determine the suitable design and construction of the machine/tool.

Both the abrasive harness method and the ball pressure method by Turner-Martens and Brinell respectively were explained, followed by a description of appropriate measuring tools.

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[49] M[ax] Kurrein, Fräser und Fräsmaschine – Cutter and Milling Machine, in: Werkstattstechnik XXII, 1929, 253-263

[50] M[ax] Kurrein, Die Materialprüfstelle einer zeitgemäßen Maschinenfabrik nach den Erfahrungen der Werkstoffschau 1927 – Material Testing in a Modern Machine Factory According to Experiences of the Working Material Fair 1927, in: Werkstattstechnik XXII, 1928,33-42

The monograph on lathes, published by Kurrein in 1929, impressed by the unique scrutiny and detail the topic was subjected to[51]. The producers, whom Kurrein had asked for co-operation, nearly always supplied him with their newest models which enabled the author to keep abreast of developments at all times. The topic was divided into groups according to

- multiple cutting lathes, developed on the basis of the lathe,
- specialist machines,
- gun lathes and automatic lathes.

The text described in detail and with the help of numerous drawings and diagrams of the drive, tool heads, tool head controls, beds, bed cross sections etc. each of the above subdivisions. The book finishes with explanations of tools and tool controls/settings. Using work pieces of the same type, Kurrein demonstrated the working techniques of the different machines. The book was intended for tool engineers and machine tool engineers, production engineers and students[52].

An essay by Kurrein and Schlesinger, written in 1930, dealt with the ”Drilling of Cast Iron in Precision Mechanics”. In precision mechanics ”thin walled pig-iron casting with skin” was almost exclusively used. Drilling in precision mechanics was often the most important part of the continuous production process. The workings of a factory therefore largely relied on the quality of the drilling tools. The question the tests of the experimental machine tools department addressed, was “whether the high end product should be used or whether a lower grade substitute will suffice”. A total of eight 5mm high speed steel drills were subjected to drilling tests of a systematically comparable nature. In order to be able to transfer the results to normal factory conditions, the drill bits were used ”as delivered” and inserted into the chuck that was supplied with the machine. ”The bits were subjected to identical drilling action without pause until they became blunt”. Constant pressure was applied ”common to most drills of that kind”. Results varied greatly between the different makes. However, similar differences could also be observed between bits of the same company. Drilling performance decreased surprisingly rapidly with ”the shortening of the bit through use”. ”The drill bits with the best performance” made the one exception to this generally applicable observation[53].

Between 1926 and 1932 Max Kurrein, as chair of the experimental department for machine tools, was involved in the so called ”Steel Fight[54]”- assessment about workability of structural steel in the automobile industry, which Georg Schlesinger

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[51] Max Kurrein, Vielschnittbänke, ihre Konstruktion und Arbeit – Multiple Cutting Lathes, Their Construction and How They Function, Berlin,1929

[52] Compare book review, in: Werkstattstechnik XXII, 1929, 689

[53] Compare G[eorg] Schlesinger/M[ax] Kurrein, Das Bohren von Gusseisen in der Feinmechanik, in: Werkstattstechnik, XXIV, 89-91, quotes: 89, 90.

[54] German original: Stahlstreit

was asked to conduct by the Reich's ministry of transport and the Reich's federation of automobile industry. All tests under Schlesinger's supervision had been finished by 1930. It is probable that Kurrein supervised the thesis by the assistants Pátkay and Meyersberg, which was produced as part of and along with the assessment and which Meyersberg had asked the Technical College for permission to write in 1927 as well as that of Plagens, who gained his doctorate with a thesis on "Cutting Force and Tool Life During the Turning of Alloyed Construction Steel"[55]. Kurrein was to stay in personal contact with both Pátkay and Meyersberg beyond their time together in Charlottenburg.

From 1929 until 1932 only few articles can be found in "Werkstattstechnik" on measuring techniques by Kurrein. He was satisfied with presenting newly designed measuring devices and detailing their use. For example, his essay on "Measuring Milling Cutters" describes a device which the Reicherter company had designed to measure existing milling cutters with arbitrary angles[56].

Of Schlesinger's team members it was especially Kurrein who once again occupied himself with in-depth research of cutting processes. Since the days of Babbage and Thime many engineers had studied cutting processes, but there were still many unanswered questions. In the last article he published in "Werkstattstechnik" in 1932, Kurrein dealt with this problem and added his thoughts on future developments. Kurrein's main aim was to study the laws governing plastic deformation, which he hoped to analyse in two different ways:

> The first task is to explain the cutting shape, its relationship to the cutting angles, the cutting speed and its relationship to the ductility of the material to be worked. The second task is the determination of the specific cutting force and its dependence on the material constants of the materials to be worked. The first real law governing cutting rules will be made up of the two solutions.[57]

In the early twenties the ministry for science, art and education allowed Max Kurrein to act, apart from his position at the Technical College in Charlottenburg, as technical expert at court. Before long he became technical expert at the district court

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[55] Compare data sheets for Georg Schlesinger's above mentioned assessment, Der heutige Stand der Bearbeitbarkeit der Baustähle für den Automobilbau, Charlottenburg 27.1.32,3.-archive IWF.

[56] M[ax] Kurrein, Messung von Fräsern, in: Werkstattstechnik XXII, 1928, 307-308. Further articles: M[ax] Kurrein, Akustischer Dehnungsmesser – Acoustic Expansion Measurer , in: Werkstattstechnik, XXII, 1929, 541-542; M[ax] Kurrein, Temperaturkontrolle mit dem neuen optischen Pyrometer"Optix" – Temperature Control with the new Optical Pyrometer "Optix", in Werkstattstechnik, XXVI, 1930, 307-308; M[ax] Kurrein, Geräte zur Härtebestimmung – Tools to Define Hardness, in: Werkstattstechnik XXVII, 1933, 176-179

[57] M[ax] Kurrein, Überblick über die Zerspanungsforschung – Overview of Cutting Research, in: Werkstattstechnik XXVI, 1932, 41-45 and 64-66, Quote: 41

in Berlin[58], followed by the highest court in Germany at the time, the Reichsgericht. Both courts asked him in 1925 to deliver his opinion on related cases involving the patent for shavers. The involved parties were the German subsidiary of the Gillette Safety Razor Company Co. GmbH. in Hamburg and the machine tool maker Alfred Schlüßler from Berlin-Neukölln. Gillette won both cases, but Kurrein was involved in a separate dispute with Schlüßler about the contents of his expert opinions made available to the courts. Schlüßler's final defeat against Gillette at the highest instance did not discourage him to pursue his interests otherwise. He concentrated his efforts on the technical expert Max Kurrein, whom he accused of favouring Gillette despite knowing otherwise. Statements of contemporaries make clear that criticism of experts following a defeat at court was by no means an exception. However, the argument between the two parties quickly took on a different hue. Schlüßler employed means to continue the dispute which could be called unscrupulous and continued to harangue Kurrein until 1933. The conflict overshadowed Kurrein's last years in Berlin and is not without consequence with regard to his professional development. The dispute shows the changing mood in the academic world in general and at the Technical College in particular prior to 1933. The main points of the dispute will be discussed below.

In 1925 the Gillette Safety Razor Company Co. GmbH. Hamburg sued the engineer Alfred Schlüßler, machine tool maker in Berlin-Neukölln, because he was supposed to have broken the licence for safety razors (D.R.P..no. 379742) held by the American parent company and given to its German subsidiary in Hamburg[59]. The dispute was settled in favour of the Gillette company in the first instance by the Landgericht I on 30th December 1927. The appeal proceedings were held at the superior court of justice in Berlin. Schlüßler lost a patent nullity action against Gillette GmbH. at the final instance at the Reichsgericht. In both cases the central issue was a patent question, on which Max Kurrein, as technical expert, was asked to give his views. His opinions, drawn up in April 1926 and January 1927[60], went against Schlüßler, who, in turn, accused Kurrein of knowingly wanting to mislead the court. Further he stated that Kurrein was paid for this by the Gillette company. He went on to call on the services of a retired professor from the Technical College in Dresden, Professor Hundhausen, and asked him to perform a separate, private evaluation. In it, Hundhausen supported Schlüßler in his views. On 15th March 1928 Schlüßler not only officially accused Kurrein of fraud, but also asked the director of the Technical College Berlin to instigate a disciplinary investigation. It was completed in December

[58] German original: "Berliner Landgericht"

[59] I.HA, Rep. 76, Vb, Sek. 5, Tit. III, no. 5c, Beiheft I - the senior public prosecutor at the Landgericht II to the chief state prosecutor at the superior court of justice (Berlin). Letter of 20th January 1930 (10 pages)

[60] GStAPK, I.HA, Rep 76, Vb, Sek. 5, Tit. III, no. 5c Beiheft I, Bl. 262 - letter from the dean Matthias to the director of the Technical College, 28.2.1931

in favour of Kurrein. The fraud inquiry was suspended in 1928 and finally laid to rest in February 1930[61].

Following his various defeats, Schlüßler tried not only to disprove Kurrein's reports in various open letters to the press, but also to discredit him as a technical expert. The first of these attempts was an essay entitled "The Misleading of the Judicial Patent Senate by Means of a False Report and its Consequences"[62], which appeared in no. 5, vol. 62 of the magazine "Der Maschinenkonstrukteur" in March 1929 and was subsequently duplicated and distributed in the Technical College Berlin. This anonymous essay – Schlüßler later admitted to being the author – stated, that the judgement was based on fraudulent processes, which came about by the collaboration of a judicial technical expert and a wealthy American company. Kurrein's name, however, was not mentioned. Later, in August 1929, Schlüßler had two essays printed in the specialist periodical "Messer und Schere"[63], which dealt with Kurrein's occupation as a judiciary technical expert. The first, published in no. 15 on 1st August, was titled: "The Ways the Gillette Company Seeks to Quell Competition and How to Confront This Situation"[64] and repeated, without naming Kurrein, accusations of fraud, while the second, entitled: "How the Gillette Company Achieved its New Patent, Withheld it From Nullity and Misused it for Infringement Suits"[65], published on 17th August, did specifically name Kurrein. The editor's office of the magazine stated that it was in the interest of German industry to uncover "the means by which certain foreign companies try to harm German business". The "defender of his rights, who has had to bear heavy losses", none other than Schlüßler, thought up a web of conspiracy with Kurrein at its centre:

> The main culprit is Professor Dr. Techn. Max Kurrein, lecturer and assistant and currently deputising for Professor Dr.-Ing. Georg Schlesinger, chief engineer of the experimental department for machine tools at the Technical College Berlin-Charlottenburg. First he was won over by the big fraudulent company in order to be slotted into the judicial process as a technical expert...[66]

Schlüßler was to repeat his accusations in "a much clearer form" in 1929 in a private lawsuit against Kurrein at the inferior court in Charlottenburg.

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[61] 1. HA, Rep. 76, Sek. 5, Tit III, no. 5c, Beiheft I - the senior public prosecutor at the Landgericht II to the chief state prosecutor at the superior court of justice (Berlin). Letter of 20th January 1930

[62] German original: "Folgenschwere Irreführung des Reichsgerichtlichen Patentsenats durch ein falsches Gutachten"

[63] "Knife and Scissors"

[64] German original: "Mit welchen Mitteln die Gillette-Gesellschaft ihre Konkurrenz niederzuringen sucht und wie ihr entgegenzutreten ist"

[65] German original: "Wie die Gillette-Gesellschaft ihr neues Patent erlangte, der Nichtigkeit entzog und zu Verletzungsklagen missbrauchte"

[66] 1.HA, Rep 76, Vb, Sek. 5, Tit. III, no. 5c, Beiheft I, p. 103

Prior to that, however, it was Schlüßler and the people responsible for publishing his various articles, who attracted a number of lawsuits. The director of the Technical College handed in a libel lawsuit to the Berlin superior court II on 28th November 1928 followed by another because of the distribution of libellous articles from ”Messer und Schere” aimed at staff of the Technical College on 21st December 1929.

Max Kurrein filed a libel lawsuit against Hundhausen and Schlüßler in the same court on 5th October 1929 because of the results of the private report and the distribution of the said article in the ”Maschinenkonstrukteur”.

Both the American Gillette company and its German subsidiary, including members of the board, filed a lawsuit for libel and unfair competition against Schlüßler and the publishers on 30th October 1929[67].

Lawsuits of this nature were the main feature of the conflict between the two parties until Kurrein was relieved of his position at the Technical College in the summer of 1933. A true reconstruction of the lawsuits' details has not been attempted to this day. A preliminary examination has suggested that between 1927 and 1932 eight lawsuits have been filed, all of which but one were decided in Kurrein's and Gillette's favour. Events were mainly determined by Alfred Schlüßler, who did not stray from his version of events and persisted in levying accusations against Kurrein in order to reverse the decision of the courts to his favour. The Berlin justice department finally commented critically on Schlüßler's activities with the superior court rejecting a lawsuit filed by Kurrein with the following words:

> It shall remain an unanswered question whether the necessary requirements of §51 STGB apply to the accused. In any case it is obvious that his judgement in his disputes with the Gillette company lacks the necessary understanding. He is irreconcilably convinced that justice is on his side and that the decisions are only attributable to the deviousness and unlawful conduct of his adversaries and their helpers. His efforts are obviously such, that he will refer all lawsuits, whether civil or not, finished or still to be decided, to a higher instance. One would only yield to him by filing a further lawsuit[68].

[67] 1. HA, Rep. 76, Vb, Sek. 5, Tit. III, no. 5c, Beiheft I - the senior public prosecutor at the Landgericht II to the chief state prosecutor at the superior court of justice (Berlin). Letter of 20th January 1930

[68] GStA PK I. HA, Rep. 76, Vb. Sek. 5, Tit. III, no. 5c, Beiheft II, p. 121 - Kurrein to the director of the Technical College Berlin, 10th February 1933. Kurrein forwarded the content of a letter of the chief state prosecutor at the superior court I to the barrister Dr. Isay, dated 23rd July 1932 (reference number 13. J. 1202/32): Rejection of a further lawsuit against Schlüßler on the grounds of a lack of public interest (marked by Kurrein as a quote in his letter to the prosecutor). German original: Ablehnung der Einleitung eines Strafantrages gegen Schlüßler, da ein öffentliches Interesse aus folgenden Gründen nicht vorliege.

Behind the judicial actions, a second level of activity developed. Numerous engineers, amongst them respected machine tool experts as well as the administration of the Technical College quarrelled about Kurrein and his reports. Here, too, a mood swing could be observed. Following prolonged support by the Technical College and the respective ministry, Kurrein's followers yielded, contrary to all their previous promises, to the pressure exerted by the up and coming national socialists in the autumn of 1932.

The director of the Technical College at first supported Kurrein by filing the above mentioned libel lawsuit in October 1928:

> Prof. Kurrein, in his position of chief engineer, is a civil servant. His position as lecturer cannot be separated from his official capacity. There can be no doubt, too, that his status of Professor and the fact that he is member of staff of the biggest technical college in Germany, contributed to the highest court in the land appointing him as technical expert. The insults levied against him are thus both against his profession and against the civil service. This constitutes an offence under §196 RstGB. As director of this institution it is my duty to file a lawsuit against the perpetrator of these undoings[69].

The director's lawsuit was previously approved by the ministry. The ministry's director, Otto von Rottenburg, made the following comments on the accusations levied against Kurrein:

> I notice that, unfortunately, it is not uncommon that parties which are involved in a court case take out disciplinary suits against technical experts, whose report happened not to be in their favour. I consider it absolutely necessary that in such cases experts, who have acted to the best of their knowledge, are protected. To this end I have allowed the College and Professor Kurrein to file a libel lawsuit against Schlüßler[70].

Both the ministry and the courts had Kurrein's reports verified. To begin with Professor Schwerd of the Technical College of Hannover was asked to perform this task. Schwerd, however, refused following accusations by Gillette's lawyer Hermann Isay of having contravened impartiality rules. Isay made his accusations on the basis of an exchange of letters lasting a number of weeks between Hundhausen and

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[69] Quoted from: 1. HA, Rep. 76, Vb, Sek. 5, Tit. III, no. 5c, Beiheft I - the senior public prosecutor at the Landgericht II to the chief state prosecutor at the superior court of justice (Berlin). Letter of 20th January 1930

[70] 1. HA, Rep. 76, Vb, Sek. 5, Tit. III, no. 5c, Beiheft I - Verfügung, signed von Rottenburg, Berlin 4th February 1930

Schwerd[71]. They even met in Hannover in December 1928. Schwerd stated that the reason for his refusal was due to time pressure . To Isay's complaints he said the following:

> Professor Hundhausen has, unfortunately, following my appointment as expert to the court not discontinued writing to me; and I have already complained to him about this when we met in Hannover[72].

Schwerd stated, that he had received Hundhausen's letters, but did not take any notice of them, let alone reply to them, simply due to the pressure of work. Schwerd rejected Isay's suggestion of knowingly co-operating with Hundhausen.

Instead of Schwerd, Professor Gottwein of the Technical College Breslau was appointed expert in October 1929. Gottwein's investigation had two central points:

> Does Professor Kurrein's report to the highest court of the land in connection to the patent law case between Schlüßler and Gillette contain gross scientific shortcomings or mistakes?
> If so, are they of sufficient gravity to justify an accusation of negligence of duties against Professor Kurrein?

Gottwein answered both his questions in "the negative". "Kurrein's report" did not contain scientific shortcomings nor was it presented in a way that justified accusation of negligence of duties. The expert to the court, Professor Kurrein, had applied himself to the rather complicated task with great correctness and expertise. He had not only paid full attention to the drawings, but also to the production of the apparatus as well as its usefulness in practical day to day life. It is thus not correct to mention scientific shortcomings or mistakes in connection therewith[73].

The faculty of machine tools had Kurrein's reports verified by two professors of the Technical College. The faculty entrusted Professors Krainer and Weber with the task of determining whether "each one of you, without having any knowledge of Kurrein's report, comes to the same or a very different conclusion as to that of the expert to the highest court of the land, Kurrein. You are to use the same reference material and answer the same questions as those handed to Kurrein by the court". In February 1931 both came "to the same conclusion as Kurrein...". A charge of wilful

[71] 1. HA, Rep. 76, Vb, Sek. 5, Tit. III, no. 5c, Beiheft I, p. 35-49
[72] 1. HA, Rep. 76, Vb, Sek. 5, Tit. III, no. 5c, Beiheft I, p. 56
[73] 1. HA, Rep. 76, Vb, Sek. 5, Tit. III, no. 5c, Beiheft I, p. 74

deceit of the court could simply not be supported, as it was levied without a shred of evidence[74].

Finally, in the summer of 1932 - five years after he had completed his report in the case between Gillette and Schlüßler - Kurrein had it corroborated by three independent investigations. Schlüßler had been defeated in a number of court cases against Gillette, the Technical College Berlin and Kurrein; the faculty, the board of the Technical College and the appropriate ministry had attested Kurrein's conduct to be correct on numerous occasions. However, none of this hindered Schlüßler in pursuing his course of action. In November 1931 a further "report in the lawsuit against Professor Max Kurrein" appeared, drawn up by the superior councillor in the ministry for transport[75], van Heys, in which he alleged to have found mistakes in Kurrein's measurements[76]. The measurements were made in the physical-technical Reichs institute Lichterfelde[77]. Kurrein made public "severe objections" and protested, amongst other things, against the title of the report, which evoked the impression, that his personage was in question. Van Heys had "utterly abandoned" any pretence of impartiality. To his amazement Kurrein had witnessed during a meeting on 26th August 1931 in the expert's study, "that the expert already knew the other party"[78].

In support of Kurrein's suspicion that Hundhausen and Schlüßler influenced the superior councillor to the ministry's expert, we can list the - in today's eyes - not entirely impartial wording in van Heys' report. However, it cannot be proven. The fact remains, however, that those who combined to file a final lawsuit against him, worked closely together. In October 1932 the national socialist member of the Prussian parliament, the lawyer Hermann Muhs, wrote a personal letter to the superior councillor at the ministry for science, art and education, Otto von Rottenburg. Muhs wrote, that he, "in order to get a personal insight into the matter", had ordered a "report on Prof. Kurrein's report" from a Mediation Centre for Engineering and Scientific Studies in Göttingen[79]. It was beyond doubt that the original report was "purposely falsified". Muhs asked for news "whether the ministry of education and cultural affairs is willing to take action against Kurrein"[80].

Muhs started acting on behalf of Schlüßler's in the autumn of 1932. He asked the director of the Mediation Centre for Engineering and Scientific Studies in Göttingen, Gustav Messner, for a report on Kurrein's report. Apart from being director at the aforementioned institute, he was also assistant to Professor Betz at the

[74] 1. HA, Rep. 76, Vb, Sek. 5, Tit. III, no. 5c, Beiheft I, p. 264
[75] German original: Ministerialrat im Verkehrsministerium
[76] 1. HA, Rep. 76, Vb, Sek. 5, Tit. III, no. 5c, Beiheft I, p. 378
[77] German original: Physikalisch-Technische Reichsanstalt Lichterfelde
[78] 1. HA, Rep. 76, Vb, Sek. 5, Tit. III, no. 5c, Beiheft II, p. 17
[79] German original: Göttinger Vermittlungsstelle für ingenieurwissenschaftliche Untersuchungen
[80] 1. HA, Rep. 76, Vb, Sek. 5, Tit. III, no. 5c, Beiheft II, p. 35

Experimental Aerodynamic Institute[81]. On top of that he had been a student of Professor L. Prandtl, who at the time was director of the Institute for Practical Mechanics[82] and the Kaiser-Wilhelm-Institute for research into fluid dynamics[83] in Göttingen[84]. Following Muhs intervention at the ministry it was Prandtl, who corresponded with von Rottenburg about the results of his former student. He vouched for Messmer's dependability and said about his colleague at the Technical College in Berlin:

> Since your question about the matter, I have asked for information and am convinced, that Mr. Kurrein's report did exceed by far all legal boundaries. The worst findings are not even listed in Messmer's first write-up, but will be included in the one which he is currently writing[85].

Prandtl made so categorical a judgement even though, so he admitted, he had not personally gone through any of the disputed reports. A further expert opinion, which was to "comment on Messmer's version of events" would not be necessary, he continued in his letter to von Rottenburg, "as I am of the opinion that the new version of Messmer's report, due to be released any day now, will enable you to judge for yourself."

Following further correspondence between von Rottenburg, Prandtl and Messmer in December 1932, all of which was held in an exaggeratedly polite tone and in which Messmer once again confirmed, that he wrote the report on Muhs' request, von Rottenburg decided in February 1933 to bring to an end "the Kurrein case, which has cost all of us time and nerves for many a year now." He decided to ignore the previous reports, which had supported Kurrein in his findings and wrote to Prandtl in no uncertain terms:

> That the matter has still not reached a conclusion may be attributed to Schlüßler's and Hundhausen's failure to put their case in a convincing manner. I feel that what we need are the following:
> (...) either: false statements or measurements; these would have to be set against their correct counterparts,
> or: false deductions or conclusions; in this case one would have to set the proper reasons against the incorrect ones.

[81] German original: Aerodynamische Versuchsanstalt
[82] German original: Institut für angewandte Mechanik
[83] German original: Kaiser-Wilhelm-Institut für Strömungsforschung
[84] 1. HA, Rep. 76, Vb, Sek. 5, Tit. III, no. 5c, Beiheft II, p. 65
[85] 1. HA, Rep. 76, Vb, Sek. 5, Tit. III, no. 5c, Beiheft II, p. 65

This would provide a basis for a genuine conclusion of the matter[86].

One month prior to von Rottenburg's final initiative, Muhs, together with other members of the NSDAP (see footnote 1), raised an interpellationin the Prussian parliament, in which Max Kurrein and Georg Schlesinger were heavily attacked[87]. The petition had at its centre the legal cases between Schlüßler and the Gillette company. It was, however, mainly aimed at the person of Max Kurrein. The Gillette company had " achieved at the Reichsgericht " that the "Jewish Professor Dr. techn. Max Kurrein from the Technical College Charlottenburg" was chosen as technical expert. Kurrein had purposely falsified the report in favour of the Gillette company, the NSDAPsaid (see footnote 1). Furthermore the petition read that "the Jewish Professor Kurrein" was "a minion of the Jewish Professor Schlesinger", who had brought him to the Technical College Charlottenburg. Schlesinger, however, had achieved "questionable fame during the war in his involvement with weapon deliveries, all to the disadvantage of the German people". The interpellation peaked with the meeting of Kurrein and Schlüßler at the experimental department of the Technical College. During this meeting Schlüßler "had made Kurrein aware", that "a Professor of a Technical College could not possibly have made such grievous errors (in a report), as even a trainee would have been aware of them". In the presence of his assistant and secretary he had asked for the amount of the "traitor's reward", which the Gillette company had paid him and furthermore termed him "a filthy Galician Jew". Kurrein had, "despite these harsh accusation", not taken action against Schlüßler.

Kurrein took the trouble to answer to the last statement which had been made by the national socialists on behalf of Muhs and Schlüßler to the Prussian parliament. In a letter to von Rottenburg he denied the detailed contents of the interpellation and went so far as to name the above mentioned assistant, who was the doctoral candidate Meyersberg, as a witness, who could prove that Schlüßler had never sworn at him in the alleged way[88].

These events cannot be seen as having had a direct impact on Kurrein's dismissal at the Technical College Berlin. Without doubt, and other cases support this view, Kurrein would have fallen short of other measures taken against Jewish members of staff, even without his involvement in the case between Schlüßler and Gillette. Max Kurrein's fate must be seen in the wider context of the far reaching changes that had started at the Technical College even prior to assumption of power in 1933. It should be noted that the deliberate persecution of Max Kurrein by

[86] 1. HA, Rep. 76, Vb, Sek. 5, Tit. III, no. 5c, Beiheft II, p. 89-90
[87] 1. HA, Rep. 76, Vb, Sek. 5, Tit. III, no. 5c, Beiheft II, p. 91
[88] 1. HA, Rep. 76, Vb, Sek. 5, Tit. III, no. 5c, Beiheft II, p. 94

members of the nationalist socialist party and academics as well as other members of the Technical College took place a long time prior to this event.

The epilogue to the legal fight about the Gillette patents is a letter by Sethe, the senior public prosecutor at the superior court III, to the Prussian Minister of the Interior from 3rd May 1933. Sethe later sent the minister 10 documents, 24 volumes as well as 20 pamphlets concluding the "investigation against Prof. Kurrein and associates in relation to fraud and other offences". In addition he wrote a 17 page long comment on the legal case between Kurrein and Schlüßler, in which the facts are summarised and commented. Sethe finished with the remark:

> Apart from the fact that differences in opinion between technical experts within an investigation, in my view, cannot be solved, proceedings cannot be expected to reach a satisfactory conclusion, as the entire investigation did not uncover any facts relating to Kurrein having had improper relations with the Gillette company, especially that he had received any payment or other benefits from the company[89].

Apart from Schlesinger, the chief engineer of the experimental department and reader, Max Kurrein, as well as chief engineer Siegfried Ledermann are missing from the personnel and lecture register of the academic year 1933/34. Kurrein last appeared in 1932/1933. Until then he had held his "Working and Measuring Tools" lectures during the winter semester, his "Operational Studies" lectures in the summer semester and the series on "Fine-Mechanical Production" throughout the entire year, including a three hour practical. In contrast to Schlesinger's lectures, Kurrein's were struck off the lecture register without being taken up by another member of staff. Only in the context of negotiations regarding the filling of Schlesinger's chair is there any mention of filling the gap left by Max Kurrein in the field of "Fine-Mechanical Production"[90].

On the morning of 18th March Schlesinger's flat and offices were searched by four policemen and about twenty SA officers. They also went through the offices of the experimental department for machine tools used by Max Kurrein. According to Max Kurrein, his house was also searched at 6 a.m. as it was suspected that boxes of Schlesinger's might be found there. All searches are documented, the reports having been written on the same day. They were attached to a letter dated the same

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[89] 1. HA, Rep. 76, Vb, Sek. 5, Tit. III, no. 5c, Beiheft II – the senior public prosecutor at the superior court III (signed Sethe) to the Prussian minister of the interior, 3rd May 1933

[90] Compare GStAPK I.HA, Rep. 76, Vb, Sect. 5, Tit. III, Abt. 3, no. 5 A, Bd. III, no page reference, stamped; 1777, S. Vff: Letter Technical College, faculty for machine tools to the minister for science, arts and education dated 23rd March 1934, Re: Filling the Schlesinger chair, o.O. (Haifa), May 1959, 4. Documents Ina Dimon, copy PTZ archive

day, 18th March, by the acting deputy of the Technical College Krencker to Rust, the Reichs-commissioner for the ministry for science, the arts and education[91].

On the day of the "unexpected search of Schlesinger's offices" Krencker, together with the dean of the faculty for machine tools, Prof. Orlich, had "tried... in vain" to call on Rust in the ministry[92].

Krencker asked for an investigation into the accusations levied against Schlesinger and Kurrein as well as "an official explanation to rehabilitate them if the charges are proven to be false". The reports attached to the letter give further insight into the events of 18th March. They were as follows:

- The report of the main secretary of the Technical College, von Klinski, house superintendent, of 18th March about the search of Schlesinger's offices
- Schlesinger' report on the search of his flat in Karolingerplatz 9 as well as
- Kurrein's report on the search of the offices of the experimental department.

A document headed "Report" from 22nd April 1933, signed by Engel, called on the governors of the Technical College to "arrest Kurrein again". The report states that "the Jewish Professor Korrein (sic!) from the Technical College Charlottenburg, who had been in protective custody already" had appeared in his offices the previous day to take with him various folders. Kurrein apparently was the Professor, who had caused "the dismissal of some 5.000 workers" in the Solingen[93] steel industry through his "falsified report on the Gillette razor blade". There was the distinct possibility that Kurrein would "possibly" try to misappropriate important and incriminating material. It was not possible to ascertain the document's author. It is the only source stating that Kurrein – obviously still prior to Schlesinger's arrest at the end of April 1933 – had been taken into protective custody by the national socialists[94].

On 28th April 1933 Kurrein received a message from the minister for science, the arts and education, which "suspended" him "with immediate effect" from both his teaching and research duties. The letter was copied to the director of the College. Similar letters were received by other members of the teaching staff, amongst them Schlesinger, the lecturer at the faculty for civil engineering, Kelen, Professor Schwerin and the Professor for political economics Hermann Levy[95].

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[91] Compare GStAPK I.HA, Rep. 76, Vb, Sect. 5, Tit. III, no. 5 A, Bd. II, p. 269-277; The acting director of the Technical College Berlin – Krencker – to the Reichs-commissioner for the ministry for science, the arts and education, Dr. Rust. Charlottenburg, 18th March 1933, four enclosures; Max Kurrein, curriculum vitae Georg Schlesinger, (Haifa), May 1959, 4. Documents Ina Dimon, copy PTZ archive

[92] GStAPK I.HA, Rep. 76, Vb, Sect. 5, Tit. III, no. 5 A, Bd. II, p. 269-270: The acting director of the Technical College Berlin – Krencker – to the Reichs-commissioner for the ministry for science, the arts and education, Dr. Rust. Charlottenburg, 18th March 1933.

[93] Translator's note: Solingen, German town, equivalent of Sheffield (Sheffield steel)

[94] Report, signed Engel, Berlin, 22nd April 1933 - I. HA, Rep 76, Vb, Sekt. 5, Tit. III, no. 5c, Beiheft II

[95] Compare GStAPK, I. HA, Rep 76, Vb, Sekt. 4, Tit. III, Abt. 3, no. 1, Beiheft, p. 28: Suspension of Schlesinger. Suspension of Kurrein, etc.: GStAPK, I. HA, Rep 76, Vb, Seckt. 4, Tit. III, Abt. 3, no. 1, Beiheft, p. 27,29-31 and 369 (referring to Kelen's status). Compare Schottlaender, Anitisemitische

The officer in charge commented on Kurrein's questionnaire in connection to the "Implementation of the Law to Reinstate the Civil Service", which the members of the teaching staff of the Technical College had to fill out in April 1933: "100% Jew ... sympathiser of the Staatspartei[96]". The "recommendation of the main officer in charge" as well as "the result of consultations" in August 1933 was the following: "Disallow teaching activities according to §3". On Schlesinger's questionnaire it read: "To be retired according to §4". On 31st August this judgement was changed to "to be dismissed according to §4[97]". Kurrein was sent a letter on 6th September 1933 informing him of the news[98]. Georg Schlesinger was "temporarily" relieved from the civil service during his imprisonment in the Moabit jail[99].

The documents relating to Kurrein's dismissal and revocation of his teaching licence were issued and signed by the Technical College. This is in contradiction to a letter by the director of the Technical College, Tübben, to the minister for science, the arts and education from the 28th April 1933, which states that Professor Kurrein was dismissed by his chair Professor Schlesinger on 1st October. Already, Professor Kurrein had stopped working. This version of events corresponds to the last meeting between Kurrein and Schlesinger. Kurrein later wrote:

Hochschulpolitik, a.a.O., 452

[96] Translator's note: conservative, but democratic political party of the Weimar Republic

[97] GStAPK, I. HA, Rep 76, Vb, Sekt. 4, Tit. III, Abt. 3, no. 1, Beiheft, pp. 198-201

[98] GStAPK, I. HA, Rep 76, Vb, Sekt. 4, Tit. III, Abt. 3, no. 1, Beiheft, p. 159: Letter from the Prussian minister for Science, the arts and education to Dr. Kurrein dated 6th September 1933, sent by registered delivery. Further compare GStAPK, I. HA, Rep. 76, Vb, Sekt. 5, Tit.III, no. 5, Vl. II, p. 367: The minister to the director of the Technical College, letter dated 8th January 1934: "As far as we know, the two professors [Kurrein and Ledermann] left their posts on 30th September 1933."

[99] Compare GStAPK, I. HA, Rep 76, Vb, Sekt. 4, Tit. III, Abt. 3, no. 1, Beiheft, p. 202-203: Letter from the Prussian minister for science, the arts and education to Schlesinger dated 8th September 1933; and letter from Georg Schlesinger from Brussels to a "very (dear) honored friend [Translator's note: in this case female, personal pronouns in German show gender], dated 22nd March 1936. – literary bequest Schlesinger, archive PTZ

> The last time I saw him was in April 1933, when he ordered me and civil engineer Dr. Ledermann to his flat and suggested we resign our positions in order to free the teaching staff of Jews – apart from him! I asked him "to dismiss me"[100].

However, there is no document to prove that Schlesinger dismissed Kurrein. Due to sources at our disposal, one can only guess at Schlesinger's surprising behaviour and the motives which led him to take this step.

In 1933 Kurrein's name, along with Schlesinger's and Ledermann's, appeared on a list, which was compiled by the Dresden physicist H. Dember and who sent it to Zurich to the "Emergency Association of German Scientists Abroad". Dember suggested that they all be offered a lectureship at the Technion in Haifa[101]. After 22 years of working together Schlesinger's and Kurrein's paths finally parted.

When Kurrein followed the call to safety to take up his position at the Technion, he encountered a world which was nowhere near as technically advanced as his old world. On the Israeli machine tool engineers' second congress, R. E. Heymann painted an accurate picture of the situation which Kurrein faced in 1934: "The small workshops, which proudly called themselves factories, were stocked with old and maltreated machines, were badly equipped and under worse management; under no circumstances were they able to accommodate students of a machine tool faculty; on the other hand it was impossible to build up the necessary industry without such a faculty. One has to pay the highest respect to the man, who was by then 56 years of age and who had spent his entire life in well equipped technical colleges in

[100] Max Kurrein, biography Georg Schlesinger, (Haifa), May 1959, 4. Documents Ina Dimon, copy collection Spur
[101] Compare Sadmon 1994: 235

highly developed industrialised countries and how he managed to adapt to and make the best of the limited resources available to him"[102].

The words "limited resources" could also be applied to his institute. In the first years of hardship he held nearly all lectures himself; his comprehensive knowledge of mechanical engineering came in useful. His teaching included technology and machine elements, measuring science and metallurgy, industrial teaching, textile machines, agricultural machines and industrial testing. He was overseer of the teaching workshops and supervisor of countless diplomas and PhDs. On top of that, Kurrein had to adapt to teaching in Hebrew. This was made more difficult by the fact that Hebrew had no technical terms for the field of machine engineering.

Kurrein had been collecting samples of materials and tools, working processes, parts of machinery and mechanisms from his first days in Berlin onwards. He brought the entire collection to the Haifa Technion to the great benefit of his students. Not only that, but during his entire career he archived nearly all important publications regarding tools, machines and materials. He made this collection available to the faculty's library. He had, however, to do without the experimental possibilities which he had had at his disposal in Berlin for a long time. Heymann commented: "He, who was used to the well equipped experimental department in Berlin and who had done some of his best work experimenting on machine tools, must have suffered from the lack of such laboratories." Only when Kurrein had reached the age of 75 did the Technion manage to add an experimental department to its facilities. In later years he took on advisory roles to industry and the sciences as well as armaments and the military. His research was primarily in the field of precision engineering and measuring techniques. He gave guest lectures at countless universities such as Munich or the ETH in Zurich and published a standard

[102] Heymann, R.E.: In Memoriam Prof. Dr. Max Kurrein. Commemorative address on the Israeli machine tool engineer's second congress, 2nd April 1968 in Haifa. Faculty of Mechanical Engineering, Technion, Israel Institute of Technology, Haifa 1968

work on machine tools. Of special significance was his advice to the Haganah, which benefited greatly from his experience as armament engineer.

In August 1953 Kurrein himself gave a speech on the seventh international technical history congress in Jerusalem. In his talk "The History of the Machine-Tool" he outlined the contribution made by the Berlin machine tool industry. On the subject of Georg Schlesinger he said[103]:

> But today accuracy means the interchangeability of the even mass-produced parts. Although interchangeable parts have been produced in certain industries at about 1870, the real meaning of this term has only been fixed by the Dr. Thesis of Schlesinger in 1904. He introduced, based on the experiments of the machine-tool builders, L. Loewe & Co-Berlin, the basic requirements for fits and limits[104].

He remained dean of the machine engineering faculty until he was eighty, when he retired from all teaching activities and attained the title of "Professor Emeritus". He continued with his scientific work, however, until the end of his days in 1967. Because of his "great contribution to the field of mechanical metallurgy and engineer education" Max Kurrein received the Rothschild prize. In addition he received a decoration of the Haganah and an honorary membership of the Society of Advisory Engineers in Israel. The great role immigrated engineers played in developing the country can be measured by their contribution to the development of the Technion in Haifa[105]. In the Palestine/Israel Max Kurrein lectured thousands of students on machine engineering, industrial management, metallurgy and measuring techniques. These students became supervisors and directors of nearly all manufacturing plants in the Palestine, and later of the young state of Israel of which he was so proud.

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[103]Translator's note: the following text was in English and did not have to be translated

[104] Kurrein, M.: The History of the Machine Tool, Actes du Septième Congrès des Sciences, Jerusalem, Août 1953, 420.

[105] The Technion celebrated its 75th anniversary in the spring of 2000. The Technical College Berlin honoured this day with a ceremonial act. Compare Spur, G.; Federspiel, R.: "Die ersten Schritte wurden von Deutschland gemacht [The first steps were made in Germany]". The 75th anniversary of the Haifa at the TU Berlin. TU Berlin intern 4 (2000), 4. Zur Bedeutung Kurreins für das Technion [On Kurrein's significance for the Technion] compare Spur, G.; Klooster, T.: Vater israelischer Ingenieure [father of Israeli engineers]. TU Berlin Intern 4 (2000), 4.

The commemorative address in honour of Max Kurrein, held by Rudolf E. Heymann on the second Israeli Machine Engineer Congress on 7th April 1968 in Haifa, is reprinted below in full, as it imparts a picture of the Max Kurrein's personality from a very personal perspective.

IN MEMORIAM PROF. DR.Techn. Max KURREIN (1873 – 1967)

Rudolf E. Heymann[1]

Dear members of the Kurrein family

Dear Mr. President of the Technion

Dear Colleagues,

At the start of this festive Israeli Machine Engineer's Congress we should remind ourselves that this is partly a fruit of Professor Dr. Max Kurrein's life work. Very many, probably most of you, used to sit on the simple hard wooden benches – to this day called "Kurrein" benches in Technion circles – in the little auditorium no. 23, or you entered, heart pounding, his study – filled to the brim with books, pictures, documents and technological collections – in order to have him unerringly go over your projects.

That room is today empty; his occupant last set the calendar and the clock on 12th December 1966 in the same manner as he had done for decades; on 8th August 1967 he left us forever.

Max Kurrein was born on 29th April 1878 in Linz, the capital of Upper Austria; his father was the local chief Rabbi Dr. Adolf Kurrein, who soon after became chief Rabbi of Teplitz. After the young Kurrein had left the humanistic grammar school with distinction he went to Prague to study engineering science at the Prague Technical College, which awarded him the title of "engineer" in 1900. Following his

assistantship at the Technical College in Brünn, he did his PhD in Prague and became "Doctor of Technical Sciences" in 1904.

Following a number of years of practical experience in industry as an engineer in Birmingham and Düsseldorf, he became, at the age of 33, chief engineer at the experimental department for machine tools at the Technical College in Berlin in 1911; in 1913 he became senior lecturer and started holding lectures. However, his academic career was to be interrupted brutally in 1914, when, as an engineer in the Austrian army, he was given the responsibility of managing an army manufacturing plant during the first world war.

He finally returned once again to Berlin to take up his duties at the Technical College and was promoted to reader. He was active as researcher and lecturer until the national socialists came to power.

In 1934 he was appointed by the Technion in Haifa in order to build up a technical faculty. Through years of hard work he overcame the difficulties which were part of his task with great success. The new faculty grew so quickly that soon it had to be subdivided; Professor Kurrein remained dean of the machine engineering faculty up until the age of 80, when he retired from his teaching duties as "Professor Emeritus". His scientific work, however, he continued until he passed away at the age of 90.

I have retraced Professor Kurrein's career in a rather dry manner in order to enable you to understand the following. The task of a biographer begins, after all, only once the chronological framework has been completed. Only then can the achievements and character of the person who is the focus of the story be put into context of the local and temporal backgrounds from which he stems. Furthermore, the biographer has to examine external influences which furthered or hemmed

development and, finally, explain the traits of character which exemplified him and enabled him to achieve such extraordinary feats.

I believe that three factors were of enduring importance in Kurrein's life: He was a child of the 19th century, a child of the Austro-Hungarian empire and the son of a highly cultured Jewish family.

Today few remember the glamour of the 19th century which died a tearful and bloody death in 1914. But in 1878 it was still in its prime. The great wars which had swept over Europe at the beginning and the middle of the century had come to an end; the population grew rapidly and those who wanted to could travel to the new countries across the oceans. Europe conquered the world, whose fate was decided in London, Berlin and Vienna.

It was the time of the liberal bourgeoisie which was active in the economy, the industry and the sciences. The emancipated Jewish bourgeoisie of Western and Central Europe played a substantial part in this progress and enjoyed the ever improving educational facilities of the time.

The educational ideal of the 19th century was influenced largely by the humanism of the renaissance. It was the ideal of broad horizons, of universalism, which enabled universities to come into existence. Education was based largely on Aristotelian, historically orientated[2] methods of searching for the truth. This trait was to remain forever with those who had come to appreciate its methods. Was Kurrein one of them?

It may seem odd to answer this question affirmatively for an engineer, whose work was concerned exclusively with the future, but I believe I have no other choice. And I am not thinking of the occasional technical historical essays, such as his talk at the international congress for Scientific History in Jerusalem in 1953; not the theme of the work is of importance, but the intellectual approach. The key to understanding

the present lies in the knowledge that nothing, no event, no deed, no life is without consequence, but rather continues to exert influence – with changing intensity, I grant you – until the end of all days; this intellectual approach thus strives to recognise the origins of the present in the past.

One of the basic requirements for every historical paper is the existence of reliable documentation. The ability and willingness to collect such papers and other documents are symptoms of a humanistic-historical attitude. For the beholder nothing is "out of date", but documents a stage of development, be it of the economy, within technology or even of oneself; such people often collect materials all their lives for their own biography. On top of that, Kurrein collected catalogues and other documents relating to tools, machines and materials in orderly catalogued folders throughout his working life; his bequest proved to be a comprehensive list of machine tool sources over the last seven decades.

Collecting was a characteristic trait of humanistic alumni. It was customary to collect everything, not because of its financial value, but rather to still the universal interest fostered by both the parents and the school: the boy's room was – mostly to a rather unenthusiastic reaction from his mother – filled up to the brim with boxes full of minerals and ancient coins, with herbariums and animal skulls, copperplate engravings and old books. This enthusiasm stayed with many until the end of their lives and blessed were those who, like Kurrein, managed to bring under one roof their inclination for collecting, the possibility to do so and the duty which benefits from it. Thus Kurrein, from the very start of his days at the Technical College in Berlin, accumulated material and tool samples, production processes, parts of machinery and mechanisms. This collection he took with him to Haifa and it proved to be of great benefit to his students.

Kurrein's humanistic nature was certainly due to his parents; because first of all the Jewish people have, since biblical time, been an especially talented and hard working race and secondly because his father was a great scholar of the Jewish sciences and customs, himself a historian. So how did his son become an engineer?

Since Kurrein never talked to me about it personally I have to conjecture, albeit it be well founded. First of all he had very dexterous hands and enjoyed working with them. He, too, possessed an extraordinary gift of observation; often he would look at a drawing, an experiment or a finished machine only once and immediately pinpoint its weaknesses. This skill also expressed itself in his mastery of photography. His abilities necessitated that he do something else rather than spend all his time behind a desk; but they alone do not explain his choice of occupation. Perhaps setting the scene, describing the atmosphere prevalent during the nineties of the 19th century will help to understand his decision.

The predominantly historical education led, apart from all its advantages, to two undesirable side effects: Firstly it produced the unworldly and arrogant "neohumanism[3]" and secondly it led to a deep cultural insecurity. A pseudo-historical attitude began to take hold of architecture, literature, sculpture and painting, which brought with it a hollow copying of old styles. Kurrein's peers rebelled against this trend and founded a new style which experienced its heyday in Austria, especially in Vienna[4]. In Prague, too, a circle of young painters and authors existed, the most famous of whom included Rilke, Salus and Orlik. I do not know, whether Kurrein had contact with this circle during his time in Prague[5]; but numerous copies of the rejuvenation movement's magazine ("Youth"[6] published in Munich) were found in his bequest and prove that at least he took an interest in them one way or another – a fact which must have estranged him from the historicism and all its associated professions of the time.

However, the turnaround of social acceptability of an engineer had already started. The educational arrogance of the German Neohumanists had not considered the position of engineer an acceptable occupation for the greater part of the 19th century. Military officers, lawyers and scholars imagined an engineer to have bad manners and dirty hands. He only differed from a locksmith by being able to make a few calculations and drawings. As late as 1882 an excellent engineer[7] had found it necessary to fight this prejudice.

Only in the decade that was to follow, when technical advances made possible such things as electric light and the telephone, when sewing machines and typewriters had permeated every household, did the contempt previously reserved for engineers turn into admiration; a naive belief in the almighty power of engineering became a kind of religion of progress and its high priest was, of course, the engineer!

Many talented and gifted people saw the situation in a more sober and objective way. They recognised the enormous scope engineering had to offer and wanted to use their talents to further progress humanity and themselves. Instead of becoming lawyers, doctors or philologists like their fathers, this generation was one of engineers.

One of them was Max Kurrein – and that with some success; at the young age of 22 he had become an engineer, with 26 he had attained the doctorate of engineering. The subject of his PhD, " Structural Changes in Ingot Steel under Mechanical Stress" (see footnote 7) shows the subject which occupied him the most: mechanical metallurgy and metallography. His choice is not surprising. Metallography, founded in the 60's by the Englishman Sorby, had advanced enormously over the last three decades and at the time it seemed to be the key to being able to effect radical changes in mechanical engineering – with good reason. Not long after the new aluminium metallurgy had proved itself by the contribution it made to aviation, and new structural and tool steel alloys had made their way into mechanical engineering processes, the Americans presented high speed steel, developed by Taylor and White, at the World Exhibition in Paris.

That was in the same year in which Kurrein attained the title of engineer, namely 1900. Unlike most of his contemporaries, it seemed that he had recognised early on the importance of this invention for the workshop and the economy as a whole in the years to come; only 12 months after having completed his PhD, he published a research paper on the structure of high speed steel cuttings. This was his first contact with what was to become his life's work: researching cutting processes

and their effects on machines as well as the scientific research of production processes and factory management.

It would, of course, take a number of years before he could fully apply himself to this task. As already mentioned, he worked as an engineer in England and Germany – a more than sensible move, since practical experience is the best teacher for an engineer who was to concentrate on applied research and education. The mark these years had left on Kurrein showed up again and again in his publications, his choice of subjects and how he approached them.

His hour came in 1911, when Dr.-Ing. Georg Schlesinger, professor for scientific industrial engineering at the Technical College Berlin, made him his colleague and put him in charge of the experimental department. Their working relationship, documented by countless jointly published papers, came to an end only in 1933, when both, despite their achievements, were forced to leave the College by the national socialists.

One cannot appreciate Schlesinger's and Kurrein's work properly without having some background knowledge of the development of German mechanical engineering and the state of higher education in the Germany of the 19th Century.

Colleges based on the French model of the Ecole Polytechnique were founded all over German speaking central Europe in the first third of the century. However, in contrast to the French scholars, the German "neo-humanists" taught subjects such as "pure" mathematics or "pure" mechanics without referring to their practical applications. The engineer could acquire this kind of knowledge only by working in and with the industry, which itself was still on a very basic level of development.

This unsatisfactory state of affairs changed only through the Austrian Ferdinand Redtenbacher who taught "Construction Exercises"[106] at the university of Karlsruhe. However, he still handed his students tables with empirical proportionality factors instead of calculating machine elements dimensions. The director of the Federal University in Zurich, Zeuner, himself a specialist in thermodynamics, developed Redtenbacher's ideas further and divided the subject of mechanical engineering into "Theoretical Mechanical Engineering"[107], which included all mathematically calculable subjects and "Practical Mechanical Engineering"[108], which occupied itself with everything constructive. The latter he assigned to Redtenbacher's student Franz Reuleaux. Both Redtenbacher and Reuleaux stressed that pure theoretical mechanical engineering would not suffice to build machines, but that experience on the factory floor, of the materials and of the industry as a whole was a necessary component. They, along with Karl Kamarsch, Julius Weisbach, Franz Grashof,

[106] German original: "Konstruktionsübungen"
[107] German original: "Theoretische Maschinenlehre"
[108] German original: "Praktische Maschinenlehre"

Gustav Zeuner and many others started writing appropriate literature in which they tried to base the “practical” subjects on theories instead of empiricism only, as had always been the case hitherto.

The next decades saw an increasing chasm developing between the two groups, a fact described by Carl Bach in his autobiography. Mathematicians and physicists did not part from “pure science” and continued to teach on an ideological basis, which a leading mathematician and man of science of the time, Professor Felix Klein, thought already a questionable way to follow for universities, but considered it definitely unsuitable for Technical Colleges. The “practicians”, however, did not or could not recognise the possibilities that lay in approaching some problems from the mathematical stance and, likewise, dug their heels in. Alois Rieder, the most important “practician” and an excellent engineer, became professor in Berlin in the nineties. Thirty years later I attended his valedictory. His influence, however, effected that the situation gradually improved. For Riedler drawing board and laboratory were the centre of every engineer's schooling. He created technical drawings as we know them today and had his students design and construct over and over again. This method, without doubt, taught us a lot for the future. Mathematics, however, was reduced to the most basic requirements of mechanics, thermodynamics and hydrodynamics; students who tended more towards understanding natural sciences through mathematics left mechanical engineering and changed to the faculty of sciences. Only electrical engineers, under Slaby’s renowned leadership, had attained a balance between practice and theory.

Schlesinger came into this atmosphere when he started his professorship at the Technical College in Berlin in 1904. He had had Riedler, Reuleaux and Slaby as teachers and was only 30 years of age, when the Kaiser himself offered him this post. He had got to know Schlesinger during a visit to the Ludwig Loewe machine tool plant in Berlin, where Schlesinger had worked from 1897. By the time of the Kaiser’s visit he had already attained the position of works manager. The company had been founded in 1869 by the Jewish industrialist Ludwig Loewe; the first European company to be based purely on the American model. Mass production, interchangeability of parts, measuring controls, complete drawings, orderly calculations – all things which for you, as students of Kurrein, are a matter of course , but which were prior to Loewe in Germany and Kurrein in Erez-Israel altogether unknown. Other manufactures built machines by hand to order. The methods used included a lot of improvisation on the factory floor and as good as no calculations or drawings. The way to secure a contract was to undercut the competition. Reuleaux criticised the German machines on show at the Philadelphia exhibition in 1876 as being “cheap and of poor quality”.

This had changed by 1900, mainly through Loewe's example and the dramatic rise in demand of mass produced machines – especially weapons. Organisation and work floor practices had to adapt to the new demands placed upon them. Without detailed drawings and calculations modern machines such as the new combustion engines, turbines etc. could simply not be produced.

Machine tool fabrication, however, had not moved forward in terms of calculations; this is not to say that excellent work was done at the drawing board and in production. However, because of the lack of knowledge of cutting, shaving and facing processes and the forces which acted upon the materials during the operation, one had to rely on estimates, proportionality factors and such like. Science did not occupy itself with tools and machine tools; these were no subject for academic research and were instead left to the workers and engineers.

According to Schlesinger and Kurrein one of the main tasks of the experimental department of the Technical College Berlin was to close this gap. Thus they bridged one of the divides between "theory" and "practice". This time it was the "practitioners" who brought the two sides closer together. Felix Klein and his student Arnold Sommerfeld, who received the technical mechanics chair in Aachen (1900) had tried to create a more balanced approach on the "theorists'" behalf. Schlesinger and Kurrein can thus be counted as belonging to the important educators of German industry, a process which Redtenbacher had started half a century earlier.

Kurrein had not, unlike Schlesinger, been a student of Redtenbacher's, but was taught at the time when his influence in every German speaking college was at its peak. It is therefore not surprising that this is clearly represented in his work: All his research was a result of practical applications and designed to further them. He worked out a programme on the research of cutting, which later he summarised in a paper (1932). It displays a systematic approach and a clear line of thinking in the face of a complicated problem. With the help of metallurgic techniques, of which he was a master, he recognised early on that cutting is a direct result of plastic deformation. Due to a lack of time, unfortunately, I cannot go into more details, but would, nevertheless, like to report on the approach so typical of him.

According to his own methods and those Riedler promoted at the Technical College Berlin, he addressed problems not with theoretical calculations, but with a string of carefully worked out experiments. He was an excellent experimenter who knew how to use all methods at his disposal and even invented some himself. Those students whom he permitted to be present during such experiments and who he would later allow to do their thesis or PhD with him, were able to learn enormously through his strict and critical methodology; he was always willing to listen to suggestions or even different opinions and thus developed a most conducing working

atmosphere. I speak from experience, because I, too, worked for him from 1923 until 1926.

The “practitioners” accepted his results only very hesitantly. To show you the kind of difficulties he was to encounter, I would like to cite a single example: In 1929 he had worked over his article “Machine Tools” of the “Dubbel” in order to bring it into line with his latest results. One year later he received a letter from the editor, stating his article was “too scientific” and therefore not received well by the “practitioners”. His reply was, quite rightly, that “sometime, somewhere, someone will have to break with pseudo-calculations by tradesmen”.

Unfortunately, there is not enough time either to go into sufficient detail on Kurrein’s manifold scientific, journalistic and pedagogical activities during his fruitful years in Berlin. It transcended by far his work in the experimental department, comprised mainly of leading practical sessions, conducting experiments and writing research reports, and included, amongst other fields, measuring techniques, precision engineering, machine tools, appliances, production plant organisation and machine aesthetics. The great variety of subjects reminds one of the old humanistic ideal of broadening one’s horizon, the synthesis of single subjects to a common whole – an ideal which probably controlled him unawares throughout. With growing age he became a personality who managed to join both humanistic and engineering traits.

This personality could only develop itself properly once in Haifa, where work of a totally different nature from that in Berlin waited for him: It was broader, more important and of an independent nature. As sometimes happens, an event which at first seemed like a terrible act of God - in Kurrein’s case his ousting by the national socialists - turned out to be a blessing, even though it carried with it a great amount of responsibility and work.

But it was just this independent nature of the work and the responsibility which – in contrast to many of his colleagues – made him decide to accept the position in the poor and technically underdeveloped Palestine. Apart from that, his Zionist upbringing probably played a part in his decision making process, too, be it conscious or not. His father, after all, had published the “Jewish Chronicle”[109] and his maternal grandfather had been secretary to Moses Montefiore and had often visited Palestine.

Only those who can remember the state of industry of our country in 1933 can gauge the gamble Kurrein took in following the call from Ing. Shlomo Kaplansky, the former director of the Hebrew Technion in Haifa to build a technological-industrial faculty.

The small workshops, which proudly called themselves factories, were stocked with old and maltreated machines, were badly equipped and under worse

[109] German original: “Jüdische Chronik“

management; under no circumstances were they able to accommodate students of a machine tool faculty; on the other hand was it impossible to build up the necessary industry without such a faculty. One has to pay the highest respect to the man - who was by then 56 years of age and who had spent his entire life in well-equipped technical colleges in highly developed industrialised countries - and how he managed to adapt to and make the best of the limited resources available to him.

His main task consisted of planning the faculty. He dedicated himself to this with the unrelenting energy so typical for him, while at the same time psychologically preparing "factory owners" for the intake of faculty students. These owners were mostly craftsmen from Eastern Europe with very little technical knowledge and immense pride of their "many years of experience". They had a very sceptical stance towards "new academic things". In order to get the "industry", which was 100 years out of date up, to modern standards, Kurrein had to do the same educational work as Redtenbacher, Zeuner, Reauleaux, Karmarsch, Bach, Riedler, Schlesinger. However, they and many more had taken roughly 80 years to achieve this in Germany, Kurrein had to do it in a few.

Due to the lack of qualified colleagues, he held nearly all lectures himself in the first number of years; his universal knowledge of machine engineering proved to be invaluable. He lectured on technology and machine parts, measuring techniques and metallurgy, industrial economics, textile machinery and industrial quality processes, supervised the workshops and numerous diplomas and PhDs. All in all an unimaginable workload. Only someone with dedication, single-mindedness and a strong will could overcome all the problems that littered Kurrein's path. On top of that I would like to point out that because of the lack of technical terminology in Hebrew which subsequently had to be built up during many years of hard work, the change of language presented a whole new set of problems.

The continuation of his scientific work was no less difficult: Although he had at his disposal the most necessary equipment for a metallurgical measuring laboratory from his days in Berlin and managed to accommodate it in the most meagre rooms with his customary unpretentiousness, the cash strapped Technion simply had no space nor money for a machine tool laboratory. For him, who was used to the well equipped experimental department in Berlin and who had done his best work as an experimenter on machine tools, this lack of facilities must have been a bitter blow[8].

But despite all the difficulties Kurrein continued his scientific work in this country, published two books and a number of essays and was advisor and overseer to modern industry, which started to develop not least because of his input. Especially valuable was his advice to the Haganah, which benefited from his rich experience of armament production.

We can remember with satisfaction that he received the Rothschild prize because of his "great contribution to the field of mechanical metallurgy and engineer education". In addition, he received a decoration by the Haganah and the honorary membership of the Society of Advisory Engineers in Israel. They were well earned!

Gentlemen, I have tried to paint a brief picture of Professor Kurrein's personal and professional development against the background of his time. To my surprise it has become a chapter on cultural and technical history of a nearly forgotten period. With heavy heart did I have to leave out details of his research; it would have taken too long to explain them and I am not here today to give a lecture!

His collections help spread his interest and communicate it to later generations; his mineral collection is a teaching aid at a grammar school; his library, catalogue collection and technological collection will continue to be of great value to his faculty; many historically interesting technical devices from this collection will help the technical understanding of the spectators of the museum of science and technology in Tel Aviv.

When I look at this impressive collegiate of 800 Israeli engineers, which could never have taken place without the dedication and work of Professor Kurrein, I know what his greatest contribution to our country was: you, his students, whom he educated to think scientifically and functionally as engineers. That what he sowed is already being reaped and will continue to produce rich fruit to the good of our country far beyond his lifetime.

In this vain and together with the regularly cited humanism in mind I would like to finish with the closing words of a colleague from a different college, Kallimachos from the university of Alexandria, dedicated to one of his friends 2200 years ago "Don't ever say that a worthy man is dead!"

[1] Faculty of Mechanical Engineering, Technion, Israel Institute of Technology, Haifa. – Commemorative address delivered to the 2nd Congress of Israeli Mechanical Engineers on 7th April 1968 in Hebrew.
[2] Aristoteles Politika 1251a
[3] The term, as far as I know, was coined by the great mathematician Felix Klein (1849-1925)
[4] One need only recall the "Secession" in Vienna (Translator's note: art noveau movement founded by Olbrich, Hoffman and Klimt in 1897)
[5] He once wrote to me (in 1958), that "I sat model a few times for Hugo Steiner-Prag, the first time was for friendship's sake in my digs and the second time was at a do of the Society of German Artists in Prague".
[6] German original: "Jugend"
[7] Max Maria von Weber in "Wo steht der deutsche Techniker? – What is the German engineer's status?"
[8] Today we have such a facility, but it came too late for Kurrein, as he was already over 70 years old when the Technion, a few years following the creation of the state of Israel and two full decades after Kurrein had immigrated, had the possibility of expanding and building a laboratory for machine tools. After severe difficulties the late Prof. Ehrenreich – a student Kurrein's – managed to have it set up in a former factory in Haifa Bay, a good distance from the Technion.