German Diagnostic Center

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First I would like to thank Col. Black for his valuable help in adjusting this manuscript. The purpose of the presentation is to give you an impression of the German Diagnostic Center, the Deutsche Klinik fur Diagnostik, where I am the head of the computer department. I shall start with some general information about the organization and building, continue with patient management and finish with data handling. The Deutsche Klinik fur Diagnostik is a joint stock company, i. e. a completely private organization. Due to the law it is governed by the board of management, consisting of one economist and one medical doctor. They are responsible to the board of directors. However, our statutes allow the board of management to delegate all decisions concerning the medical field to the elected medical council of administration, which consists of 5 staff members. With regard to scientific purposes these counsellors are supported by an Association for the Promotion of Research at our clinic. Our medical staff consists of 45 specialists and so-called subspecialists for all those fields which were regarded as essential for an internal diagnosis.

They include in alphabetical order specialists for: allergology, anaesthesy, angiology, blood coagulation, dermatology, endocrinology, gastroenterology, geriatrics, gynaecology, haematology, and so forth on to a mathematician for biostatistics and medical documentation including EDP in my own person.

Description of the Clinic Layout

The clinic is built and partly organized in accordance with American models. It is a purely diagnostic clinic, mostly concerned with out-patients. The fifty beds in 2 wards are for the severely ill patients and for the postoperational surveillance after diagnostic procedures. The building has 6 floors with 1,100 square meters or 100.000 square feet of space. In the center of each floor is the traffic nucleus with a guiding desk for the patients. Specially skilled girls are there, who are able to answer questions and keep the patients calm in the waiting areas.

The ground floor with the entrance hall and the central appointment desk and the first floor with all the doctors with their offices around their diagnostic rooms are specially connected by stairs. The other floors contain X-ray department (third floor), library, allergologic laboratories on the fifth, general and special laboratories on the ground floor and in the basement. All technical installations, including EDP are situated on the second floor, and are thus in the middle of the communication network.

Patient Management

I am now getting to the actual patient management and its detailed organization. Some of my grey hairs have been caused by that since we had to solve the problems in half a year without any fixed figures. We expected e. g., that the capacity of the clinic could be 100 to 150 new patients per day with 50% of check-up patients and 50% with specific problems. We talked about 2½ to 3 patients per doctor, per day. All of our projections proved to be wrong. We know now our capacity amounts to 50 - 60 patients per day. 10% or even less are check-ups, the rest are very often rather difficult cases. Consequently we have two peaks in the distribution of age: near 40 and 60 years.

How are the patients in this clinic managed? The patient writes or calls us for admission. We, in response, send him a number of papers, including a special questionnaire about his complaints and previous history. This questionnaire and the forms are filled in by the patient and returned to us in a special envelope. (Figure 1). After computer evalu-

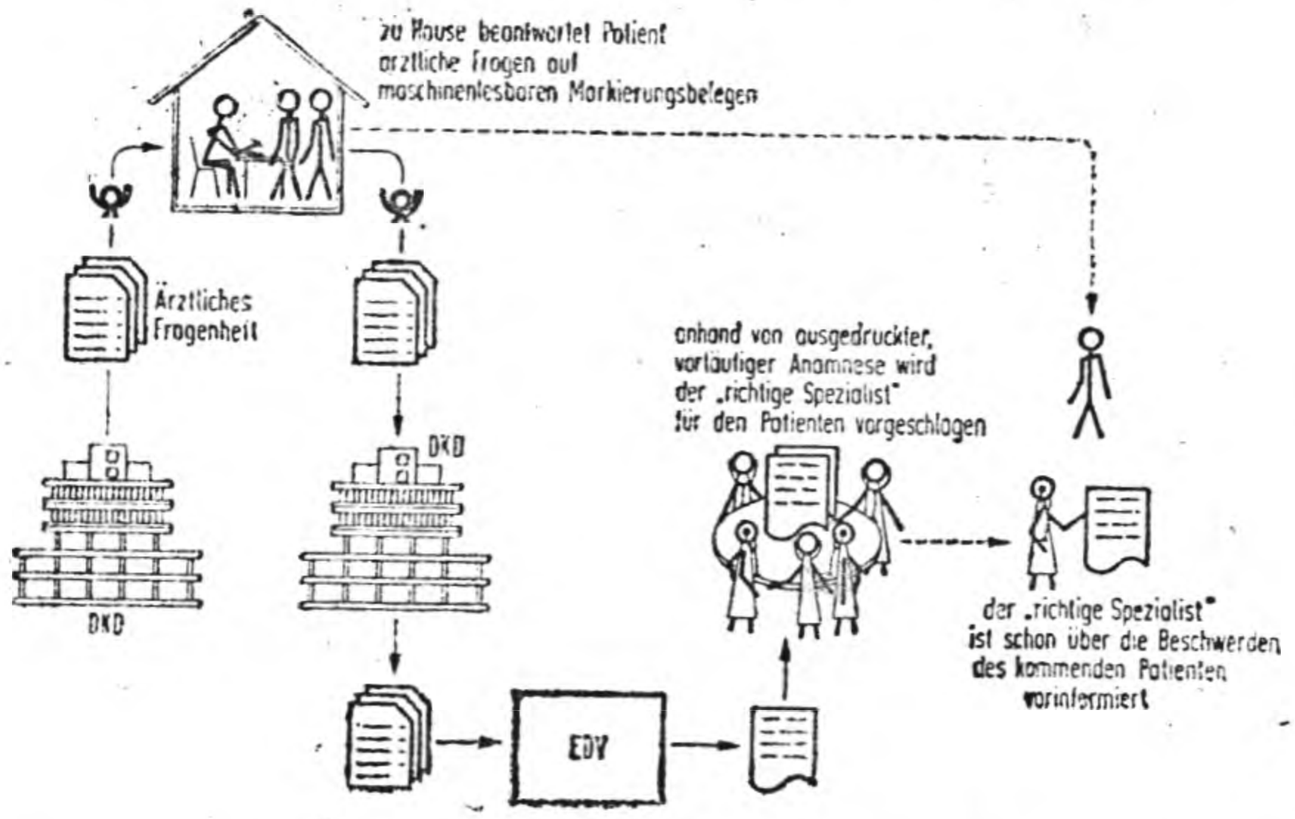

Fig. 1.

ation a doctor looks at the complaints and tries to find the right specialist for this patient. We try to assign the patient with heart complaints to the cardiologist and not to the allergist and vice versa.

Let us just have a look at the questionnaire. Figure 2 shows the questions, as the patient sees them. He should mark with yes, no, don't know answers by means of a pencil mark. Some group questions provide a branching mechanism. Figure 3 shows the computer readable mark page each underlying three overlapping pages with questions. You can see the three rows of yes/no/don't know answers. The patient gets an appointment, normally, if it is not an urgent case, for some weeks in advance. The day before the patient arrives, the computer, which already holds the patient's personal data and the questionnaire part of the previous history, prin's out quite a lot of identification material and preidentified standard forms as well as error messages about the personal data for the reception. All interested stations in the clinic get appointment lists, the doctor gets a prepared envelope with the forms and the patient's history.

Handling of Patients

The patient himself arrives in the morning. After a check of his personal data the receptionist guides him first to the laboratories where the blood and urine are taken for the standard analyses. The patient then goes to the first floor where he will be guided to his personal doctor as soon as the doctor is free, normally within a quarter of an hour. This doctor is responsible for the further diagnostic program as well as for the diagnosis itself In check cases he can, but he need not stick to a proposed check program with variations by age and sex.

The personal doctor first asks for additional information concerning the patient's history and writes them into a special form or dictates them as shown in the picture. (Figure 4). He then performs an intensive, general physical examination and marks the results on computer readable forms. You can see the lung symbol and the separation into two groups (Figure 5). Figure 6 shows the gastroenterologic region and below, the blood pressure systolic and diastolic.

Then the doctor discusses with the patient the proposed further program and fills in a computer preidentified form for each additional consultation and investigation including a special form for additional laboratory tests. I should stress the point that all specialists have a double function. They are general practitioners as personal doctors and they are requested specialists as consultants. Problems arise, when a clearly pulmonary pa-

tient comes to the rheumatologist. Therefore we will try to get advance information, but much work has still to be done.

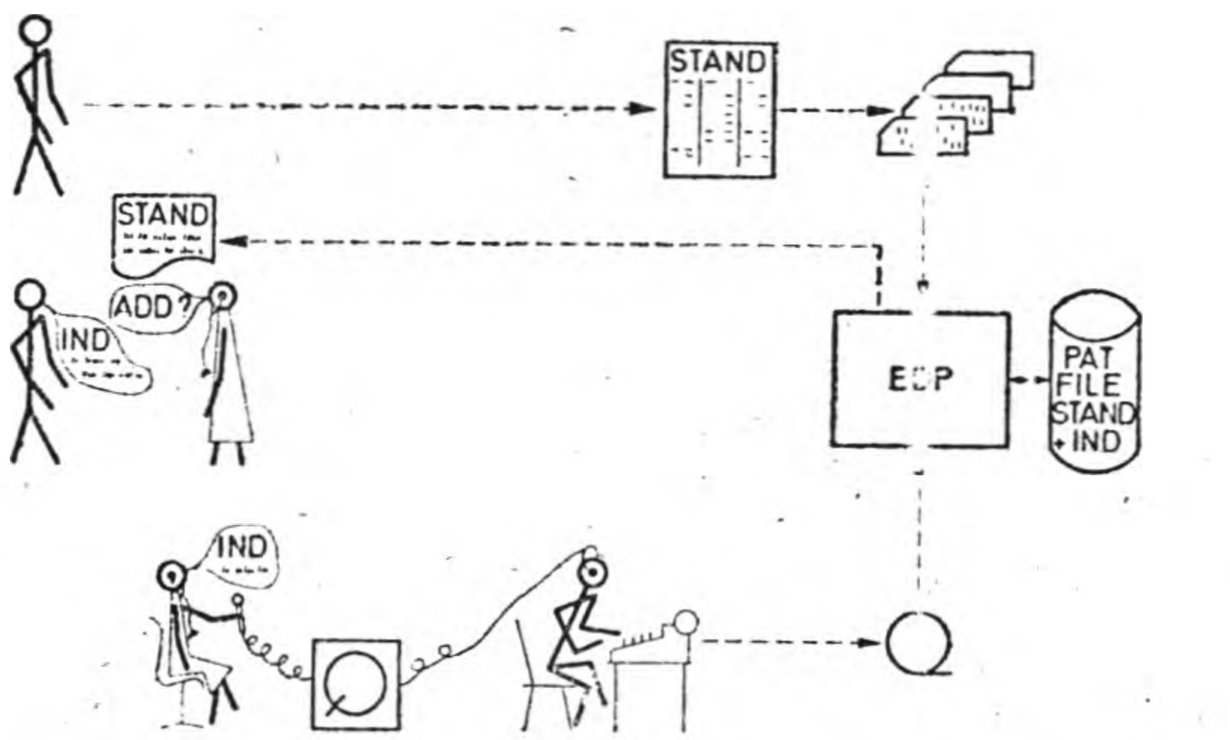

Fig. 4.

After the primary investigation the patient is guided to the ECG In the meantime the central appointment department prepares the appointment schedule for the patient. This is very difficult because a certain sequence of tests has to be followed. We don't yet use the computer for this, except for some aids by big working lists for each specialty.

With only 50 patients it is difficult to obtain a continuous flow for the specialists. There are sometimes 25 of them for the neurologist, sometimes only 10. After initial testing we had to change the capacity of some departments and are now able to plan with quite exact figures. For that purpose we have spent much time and computer work. We have now the instruments to predict the bottlenecks when we have more patients. That is, for us, very important.

After this excursion the patient's appointment schedule will be ready. He gets this little brochure with all appointments noted by day/time/and floor, eventually with additional information about necessary preparations. The last appointment the patient has is again with his personal doctor. He may restart the procedure if additional investigations are necessary, otherwise he dismisses the patient and dictates the letter to the doctor.

TO BE REMADE IN FULL PAGE LINE CUTS

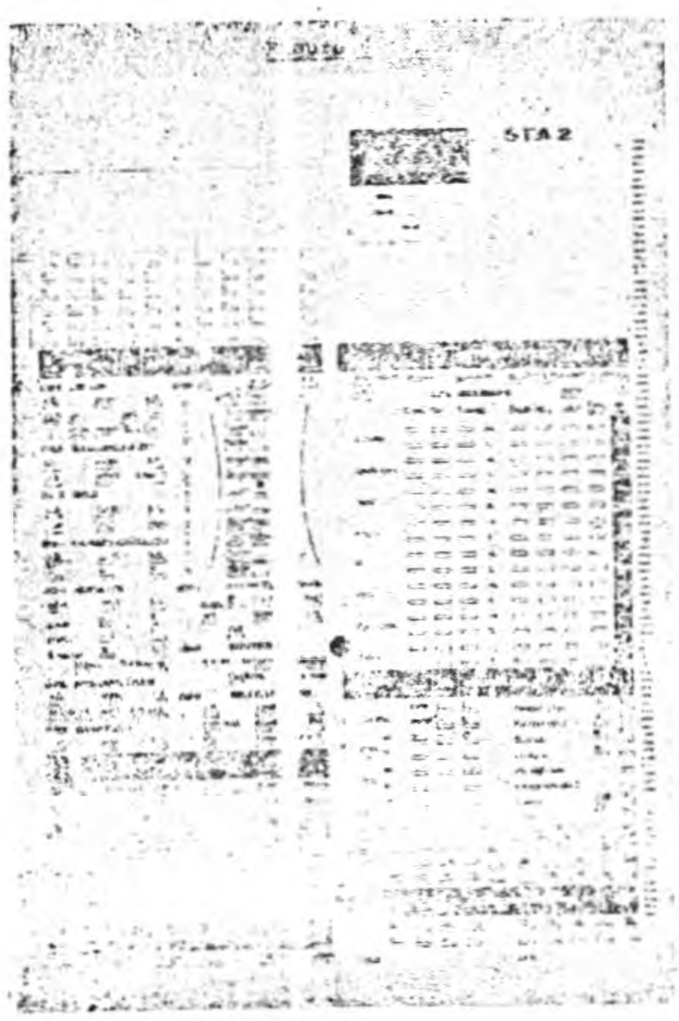

Fig. 6.

Treatment of Data

Let me now tell you how we handle the information. All data of all stations through which the patient passed during his way from the first examination to the final interview are collected in the record office — the so-called Actual Archive — a section of my department. They are kept in huge sorting boards until the patient's history comes back (twice a day) and are then given in the right order for the doctor, a problem which is not yet solved completely. The record office is the only place that has always to know where the patient's history is; again a problem.

A growing part of data from the patients comes through the EDP. The technical installations therefore are:

one central computer Siemens 4004/45 with 131 KByte
with six Magnetic/Tape Units and 3 Disc drives.
Card input and rapid line printer.

In addition we use 3 data acquisition satellite systems; one produces cards, the others magnetic tapes.

— A IBM 1232 Optical Mark Page Reader.
— A small 8 k Process-Control-Computer for the 12 IBM selectric typewriters.

and — a similar unit for the Lab-Data acquisition. Verbal Lab-Findings are fed in by typewriters (Figure 7).

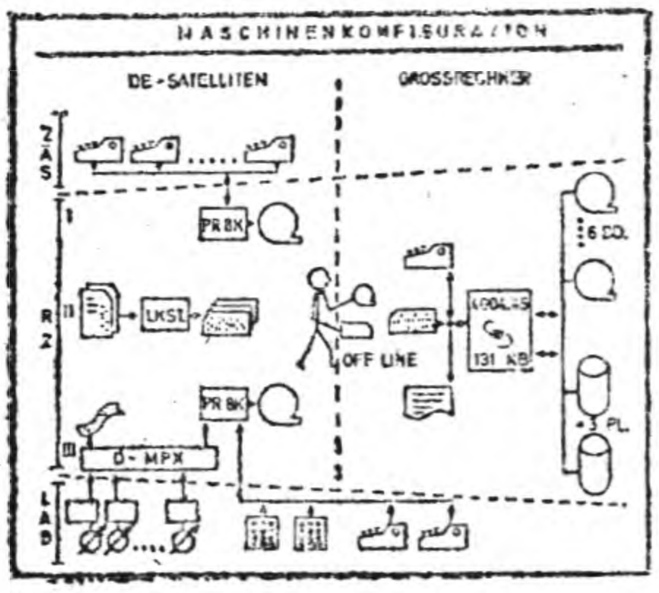

Fig. 7.

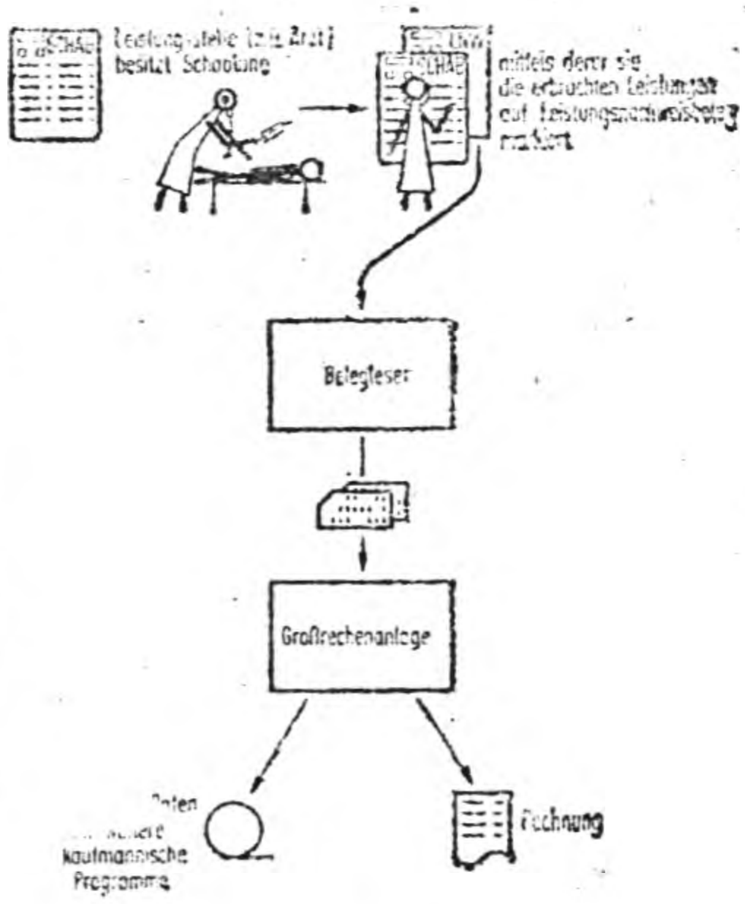

Fig. 8.

I already gave you examples of the use of the optical mark Page Reader. Another example could be the MMPI-Test. But since you already heard about that I will deal with our Accounting System. We use preidentified standard coding sheets. They are in the patient's history. Each time somebody has worked with the patient, he takes one of those sheets and marks it by means of a template. These templates are different for any unit and any doctor in the clinic. The coding forms are translated into punched cards, fed into the computer and translated into the bill (Figure 8).

The second satellite system is dedicated to the laboratory automation. Each apparatus, (at the moment 7 Technicon Autoanalyzers together with 20 channels, 1 Enzym-Automat, two Photometers) is connected to a special data conversion unit. I stress the point that peak detection and error elimination are made by hardware means. The result is only one digital dataset with free room left for the positive patient identification which Siemens has developed. The data are digitally (not analogue, as usual, multiplexed and transferred to a process control computer. Trend detection, correction and the final presentation are made off line in the big installation. This second part is not yet as good as we would like it to be but Rome was not built in one day either.

We hope to be able to present all systems working together in the next month. I have to point out another special feature of this so-called SILAB-system. At every stage there is the possibility of a control printout:

— At the analyzer the original analogue curve.

— Behind the data acquisition and conversion unit the digital printout.

— Behind the Multiplexer the punched paper tape.

— A breakdown of one part does not affect the others (Figure 9).

The third satellite system with the twelve typewriters connected to a data acquisition computer is used for both coded and free text information.

An increasing number of doctors use a kind of medical shorthand by means of a special coding sheet. Then the computer has to decode the data and make a printout, whereas, the non-coded narrative information are text-analyzed and thus coded (Figure 10). But there is not enough time to speak about the proper documentation method.

Finally I should stress again some essential points:

1. Automation is used where possible and economic but the diagnostic program is planned by the doctor.
2. Principles of our organization are:

— teamwork by the doctors
— a centralized appointment system
— a centralized data collection and data distribution system combining conventional and EDP methods
— a centralized patient-management system
— last but not least, the attempt to know as much as possible about the patient and his diagnostic needs before he comes to the clinic.

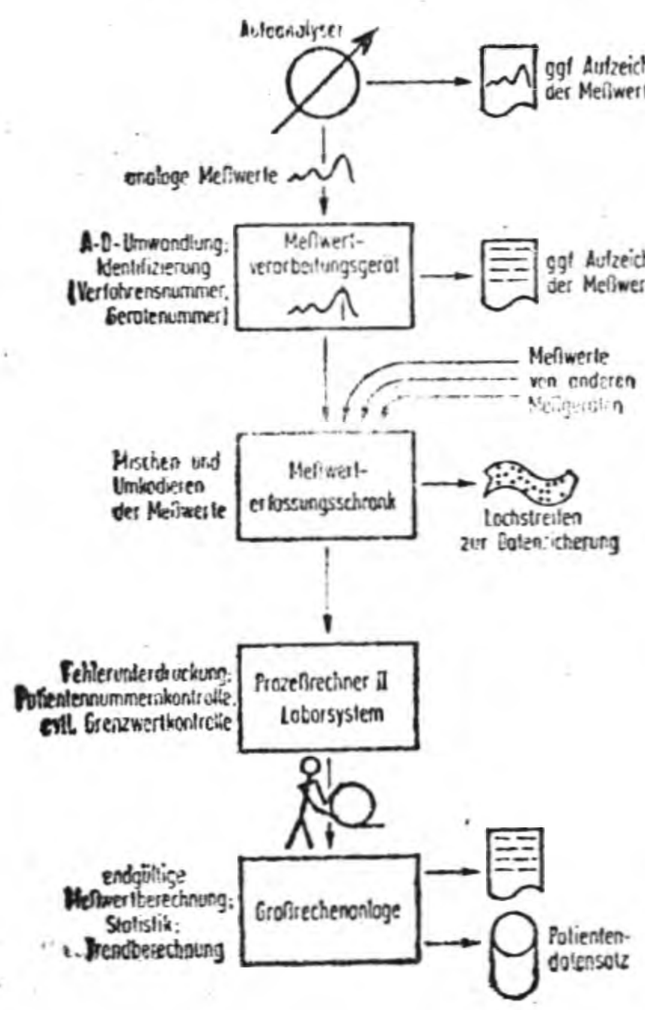

Fig. 9.

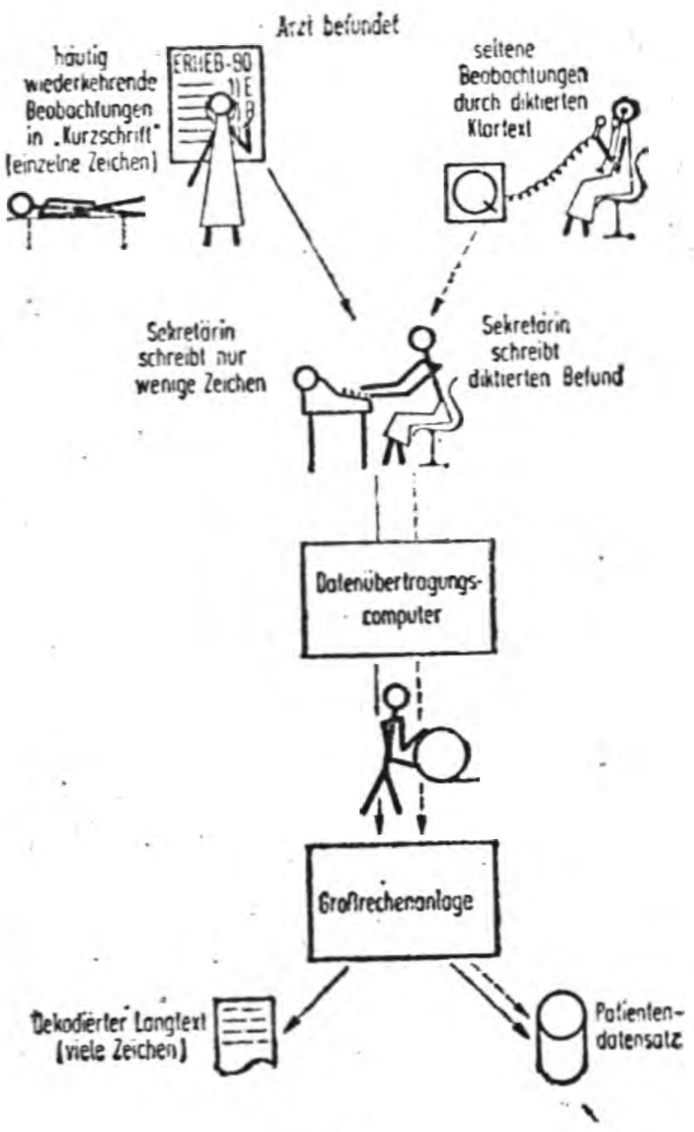

Fig. 10.