NEWSLETTER NUMBER 7

JANUARY 1979

FORCE PLATFORM GROUP

INTERNATIONAL SOCIETY OF BIOMECHANICS

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England.

Newsletter Edited by Barry D. Wilson (Secretary)
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University of Queensland,
St. Lucia,
Brisbane,
Australia 4067.

(The Newsletter is circulated free to members of the Force Platform Group. Membership enquiries to the Secretary).

Contents

The Force Platform Group of the ISB

The Group first formed in 1973 at the Fourth International Seminar on Biomechanics at the Pennsylvania State University, U.S.A. with an ad hoc committee of Peter Cavanagh (U.S.A.) and Don Grieve (England). Howard Payne (England) became 'catalogue editor' and produced two editions of "A catalogue of force platforms used in biomechanics research".

At the 1977 Sixth International Congress of Biomechanics at the August Krogh Institute, Copenhagen, Denmark, the Group re-formed itself, and elected Howard Payne as chairperson with Barry Wilson as secretary.

A biannual newsletter is produced by the Group and is sent to all members, who are asked to pay a US $5 subscription to cover the costs of producing and mailing the newsletter.

The biannual newsletter was initiated with the following objectives:

(a) To provide a bibliographic service to Group members on a regular basis.

(b) To publish original articles on topics related to force measurement in human biomechanics.

(c) To provide a forum for questions and answers on related subjects.

In this 'Message" in the Newsletter No. 1 the Chairperson urged: "Firstly, please let the editor of the newsletter have any ideas that you might generate concerning material to be included in future editions. The newsletter is a far stronger means of communication than one metting of the Group every two years, and in such a small group, we shall need input from almost every member. Secondly, if you are aware of force platform users who are not members of our group, please encourage them to get in touch with us so that we can benefit from their input".

Editor's Note

Membership in the F.P.G. remains reasonably constant. As of December, 1978 there are 92 financial members, 15 members with 1979 subscriptions due, and 2 prospective new members.

Back issues (Xerox copies) of the Newsletters 1-6 are available at a cost of $2.00 per issue. Airmail delivery from Australia is an additional $2.00 per order (Delivery time would be approximately 1 month from receipt of order).

A number of letters have been received. Details of these are included in the "Additions to the Force Platform Register". Bibliographic additions are sparse. Either 1978 has been a bad year for research or members are remiss in sending in details of their publications.

Several interesting papers have been received and will appear in this and the next issue of the Newsletter. However, more contributions to the Newsletter are always welcome. Studies submitted for publication in the Newsletter should be submitted in a form suitable for publication in English with a maximum of 8 pages typed double space and art work as black on white line drawings or photographic prints of black on white drawings of 3½" x 5" size.

Details concerning (1) the problem, (2) the platform, (3) the peripherals, and (4) how the platform can aid in solving the problem, would be appropriate for submission. Editorial changes will be minimal and should not require correspondence between the author and editor before publication. Papers should be submitted to the Newsletter editor by December 1 and June 1 for the January and July Newsletters respectively.

Finally, to those persons who have contributed to this Newsletter, thank you.

Barry D Wilson

Secretary/Treasurer's Report

F.P.G. Income and Expenditure Account

for year ended December, 1978

(covering Issues of Newsletters 5 and 6)

Income	$	Expenditure	$
Membership subscriptions nett of currency exchange and bank charges	807-05	Printing of Newsletter No. 5	108-68
Carried forward from year ending July 1977	39-89	Postal charges for Newsletter No. 5	50-77
		Xerox costs (Back Issues 1-4)	40-00
		Printing of Newsletter No. 6	100-80
		Postal charges for Newsletter No. 6	190-00
			490-25
		Balance being excess of income over expenditure	356-69
	A$846-94		A$846-94

Notes

(1) Exchange rates fluctuated around A$1 = US $1-14

(2) The F.P.G. has bank accounts in both the US and Australia.

ADDITIONS TO THE FORCE PLATFORM REGISTER

Dr. M. Dewar,
Biomechanical Research and Development Unit,
D.H.S.S. Rockhampton Lane,
London SW15 5PR,
England.

Own design, 0.61m x 0.38m
Transducers, 4 x Kistler 9251 A

Ampex FR-1800L Tape recorder (14 ch)
UV Recorder.

CCTV, Cine camera (16mm), Polarized light Goniometer

Gait analysis, leg prosthesis performance

Dr. Banri Endo
Dept. of Anthropology,
Faculty of Science,
The University of Tokyo, Hongo 7-3-1.
Bunkyo Ku, Tokyo,
Japan.

Own design, 1.8m x 0-9m
Transducers, strain gauge, three directional

Pen recorder
On line analysis

cine camera

Gait analysis in Anthropology

Dr E.B. Marsolais,
Veterans Administration Hospital,
10701 East Boulevard
Cleveland, OH 44106
U.S.A.

Own design, 2' x 1½"
Transducer, semiconductor strain gauge

Visicorder
PDP 1145 computer - A/D converter

EMG, cinematography and Selspot system, foot contacts.

Clinical gait evaluation, functional electrical stimulation in gait.

Dr T.M. McLaughlin,
Auburn University,
2052 Memorial Coliseum,
Auburn, Alabama 36830,
U.S.A.

No platform at present time
Previously worked with platform

EMG, cinematography

Musculo-skeletal modelling, sports technique.

Dr E. Michaut,
CERAVAL,
2 rue du Parc,
94460 Valenton,
France.

Own design, 0.3 x 0.7m and 0.3 x 1.7m,
Nova 3 computer, A/D converter
Benson plotter

Transducers fitted on prostheses

Mechanics of walking, normal and pathological gaits.

Prof. W. Schroder,
Inst. f. Sportwissenschaft,
Mollerstrasse 10,
D 2000 Hamburg 13,
West Germany.

No platform at present time.

Dr J. Seder
Equine Biomechanics and Exercise Physiology Inc.
Box 376, R.D.S.
Coatesville, PA 19320
U.S.A.

Own design

Telemetry, cinematography

Gait analysis, injury prediction, treatment of lameness.

Additions to the Bibliography

Aleshinsky, S.U. and Zatsiorski, V.M. Human Locomotion in Space Analyzed Biomechanically Through a Multi-Link Chain Model. J. Biomechanics 11; 101-8, 1978.

Crowninshield, R.D., Johnston, R.C., Andrews, J.G., and Braund, R.A. A Biomechanical Investigation of the Human Hip. J. Biomechanics 11; 75-85, 1978.

Endo, B., and Takahashi, A. Equipment to detect the perpendicular line of body gravity center in relation to body segment. J. Anthrop. Sc. Nippon 80; 237-249, 1972.

Conferences

Vth International Symposium on Posturography

The Vth International Symposium on Posturography of the International Society of Posturography will be held in Amsterdam, the Netherlands, from June 18-22, 1979 on the campus of the Vrije Universiteit.

Three main themes are planned:

1) Sensory Information and Postural Regulation;
   introduced by Dr. Th. Brandt - West Germany
20 Postural Regulation in Cerebellar Disorders;
   introduced by Dr. Ch. Njiokiktjien - the Netherlands
3) Posturography as a Clinical Tool;
   introduced by Dr. J.B. Baron - France

and the opening lecture will be given by Prof. Dr. T. Fukuda-Japan.

Apart from these plenar sessions parallel sessions will be arranged for the free papers about the main themes and other subjects, e.g.

Post-traumatic syndromes, Galvanic Vestibular Stimulation Orthopedics, Platform Mechanics, Data Processing, Sport, and Biomechanics

A possibility to present posters will be arranged.

The Symposium language will be English.

Further information concerning the Symposium can be obtained by The Congress Bureau of the Vrije Universiteit, de Boelelaan 1105, Amsterdam, the Netherlands.

VIIth International Congress of Biomechanics

18-22 September, 1979

Warsaw, Poland

Organizing Committee

Chairman: Prof. A. Morecki

V-ce Chairman: Prof. K. Fidelus

Scientific Secretary: Dr. K. Kedzoir

V-ce Scientific Secretary: Dr. A. Wit

Technical University of Warsaw

Academy of Physical Education in Warsaw

Secretary: Mrs. K. Jaroszewska

General Topics

General Biomechanics, Engineering Biomechanics, Medical Biomechanics, Biomechanics of Sport, Industrial Biomechanics.

Congress language: English

Deadlines

February 1, '79 - Receipt of Application Forms and Abstracts

March 1, '79 - Acceptance of Abstracts Submitted

May 1, '79 - Final Registration

July 1, '79 - Receipt of Manuscripts

Publication of Proceedings

Accepted and presented papers will be published. After the abstracts have been accepted, prospective authors will receive detailed instructions for the preparation of manuscripts, which must be submitted "ready for camera".

Social Programme

A special programme will be arranged including excursion, post-congress tours, social events, programme for Ladies.

Exhibition

During the Congress the Sport and Biomechanics Equipment and Books Exhibition is planned.

Information available from:

Polish Travel Office "Orbis".
Congress Bureau,
00-950 Warsaw, P.O. Box 146,
Poland.

The Second All Union Conference on Medical and Engineering Biomechanics

Scientific Program

1. Biorheology, biomaterials engineering.
   a) Stress and strain properties of hard biological tissues.
   b) Stress and strain properties of soft biological tissues.
   c) Hydrodynamics of biological liquids.
2. Engineering problems and biomechanics
   a) problems of biomechanics in robots elaboration and design
   b) problems of biomechanics in prosthetic engineering.
3. Medical biomechanics
   a) biomechanics of gait and stand
   b) biomechanics for operative treatment in orthopaedics and traumatology
   c) biomechanics for osteosynthesis
   d) biomechanics and new types of endprothesis and biomaterials
4. Biomechanics in sport and working kinematics.

Details of this conference may be obtained from;

H. Janson,
Rigaer Research Institute of Traumatology and Orthopaedics,
Riga 226005, Duntes Street 12,22,
Latvian SSR.

Elektroichnograph EKIG-3

A Gait Investigation and Control Device.

By

H. Janson, I. Vilka, I. Goldenstein, J. Vilks,
J. Puritis
The Rigaer Research Institute of
Traumatology and Orthopaedics,
Riga 226005, Duntes Street, 12,22,
LATVIAN S.S.R.

EKIG-3 is the newest original system designed for solving two important problems.

The first - acquisition and treatment of information about the work of separate kinematic links or systems of man with the objective of scientific research and diagnostic help.

The second - movement self-control and control with wide application to various means of modelling with the object of elimination of pathology.

The information obtained with the help of EKIG-3 allows:

1. Evaluation of the type and depth of disturbance of the normal dynamic sterotype of gait in various pathological states and during rehabilitation.

2. Discovery of compensator mechanisms and their mobilization degree in various orthopaedic diseases (coxarthrosis, valgus and varus curvatures of lower extremities, deformations of foot) or after traumas.

3. Revealing essential and secondary pathological symptoms of declination from the dynamic stereotype of gait, to determine frequently encountered, difficult to eliminate and stable combinations of pathological linear, angular and temporal characteristics of gait.

4. Classification of the main types of gait disturbances independently of etilogy or pathogenesis of lameness.

5. Determination of the optimal variant of exercises for sportsmen.

6. Optimizing the process of sports running or walking.

7. Controlling within wide limits the patients' or sportsmen movements by the help of flexible and rigid inverse connections.

EKIG-3 has been exhibited in USSR and abroad. Functional and constructive, EKIG-3 is built according to the module principle. It consists of independent blocks which are designed for definite aims. When designing and constructing the device the experience of the Laboratory of Biomechanics at Rigaer Scientific Research Institute of Traumatology and Orthopaedics by biomechanics research on patients and sportsmen with the ehlp of apparatus EKIG-1 and EKIG-2 was taken into account.

By means of the electroichnograph it is possible for the first time to get a complex information about the gait of man. All the information received is single-moment in time.

Functionally and constructively the system includes the basic module and the set of blocks to joint the basic module. The basic module is a primary transducer of information from transducers, which are a part of the system. Besides the basic module there can be other transducers which have analog output characteristics. The output signals of the basic module are transmitted to various modules, recorders, oscillographs, digital-recorders, as well as to a module of memory.

Special attention was paid to the simplicity of direction, to comfort of use and computing.

The basic module consists of the following blocks:

1. The mèthods control block. By the help of control organs you can:

- choose the method of investigation needed;
- tune the system;
- calibrate the signal;
- tare the transducers;
- within wide limits regulate the currents of train feed.

2. Gonimetry and sound leader block. In the system there are potentiometric transducers with original mechanical system of self-centering. Angle measurements are made by potentiometers in three planes simulataneously. In the information block, angle measurements are processed into electric signal, after this they are twice differentiated in order to get velocities and accelerations of the angle measurements. The sound leader gives the walking rate with a wide regulation on two scales 0,1 Hz and 1-10Hz and can be easily substituted for the light leader or there is a possibility to use them both together. The error of the graduation of leaderscale ±5%. Output capacity 2 watts. Limits of angle measurements 0-120. Number of channels - 4 -.

3. Strain gauge station. The system includes a standard strain gauge station with 8channels. The resistance of the strain gauge transducers is from 100 to 400 ohms. Four channels

are used for measurement of the deformations of bone callus, the other 4 channels are used for joining up other various transducers such as strain gauge force platform, stabilograph.

4. Feed block. As the basic module contains various devices and varous transducers are joined to it, some sources of voltage and current were needed. They are united in one block. By the help of controls which are set on the block you can:

- control the good condition of the main transducer of the system;

- control the end closers of the main transducer;

- calculate the quantity of measurements in several measurements taken separately.

Transducers of the system

The main transducer of the system is a current-conducting road (Fig 1), which consists of longitudinal strings 2, placed at 5 mm distance one from another. Strings are united by equal according to their value resistances R . The strings are interlaced with a thick thread and they make a road from 10 to 15 to 25 long and 90cm wide (180 strings). The road has three outputs, two of them (4-8) are connected with the extreme strings, the output 9 - with the string 3 in the middle of the road. Measuring or registration devices 6 and balance block 5 on the control panel of the basic module can be joined up in two basic schemes. Inscheme A the whole road makes one arm of a wheatstone as a multi-component resistor R (Fig 1).

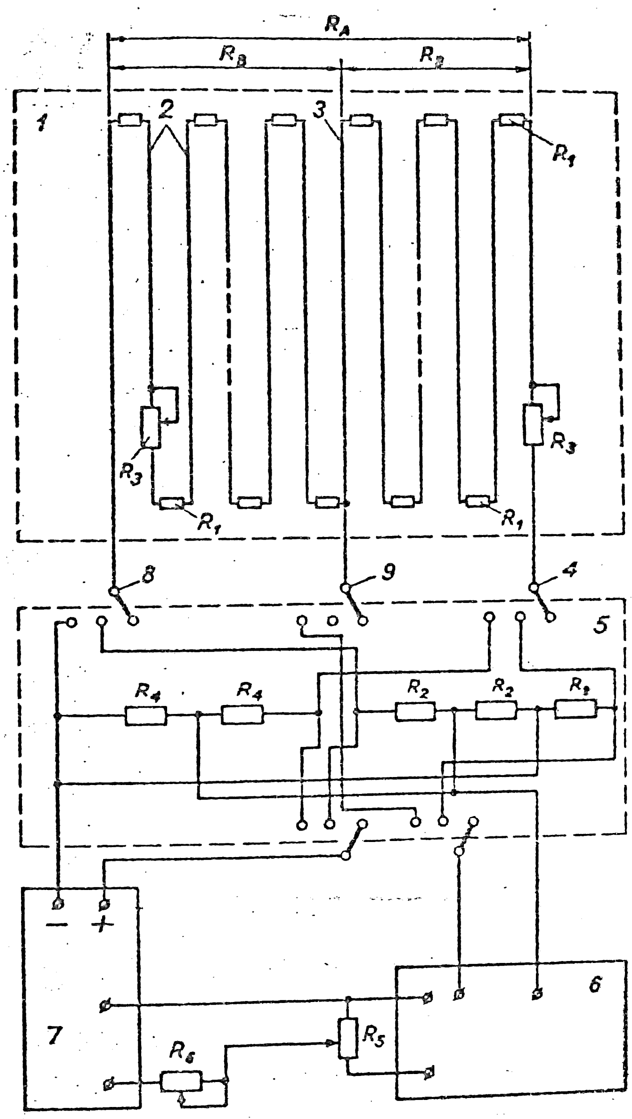

Fig. 1

In scheme B the road makes two arms of a wheatstone bridge (R). Special contact on the foot-wear of the patient shortens one or other quantity of strings. This changes the total resistance of the road, and is registered as an electroichnogramm.

<u>Different variations of engaging the road and foot-wear contacts</u>

Scheme A-1

Scheme A-1 (Fig. 2) is intended for the registration of the angle of foot turn and podogramm during the stance period.

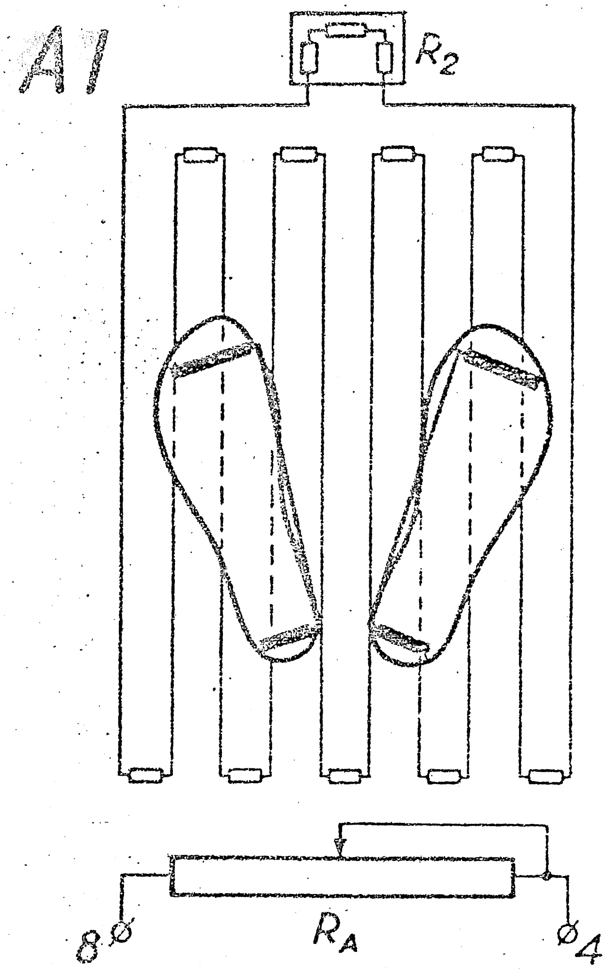

Fig. 2

On the front and the heel of the foot-wear are placed transverse copper contacts connected each with the other. The patient moves over the road and in dependence of the degree of foot turn switches off a definite quantity of strings and resistors. In accordance with this the total resistance of the road changes. The disbalance of the wheatstone is proportional to the angle of foot turn. The angle of foot turn is determined according to the calibrated curve and homogramme.

Scheme A-II

Scheme A-II is designed for the registration of podogramm,

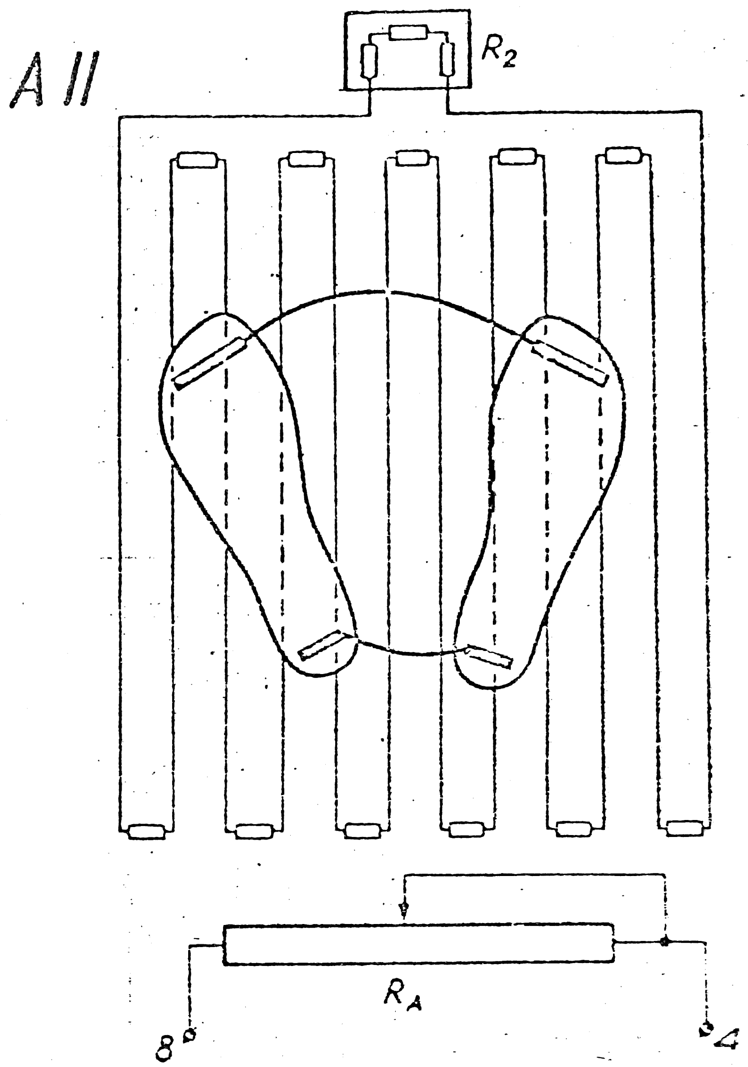

Fig. 3

the width of the step and the angle of foot turn (Fig. 3). On the front and the heel of the slippers there are placed transverse copper contacts. Toe and heel contacts of both slippers are accordingly connected one with another by means of a conductor. In the walk over the road a certain quantity of strings and resistors from the total road are switched off. During the single limb support phase is registered the angle of foot turn. During double-limb support phase one can measure the width of the step. A simple re-computation using the data about foot turn allows calculation of the width of inside parts of both heels.

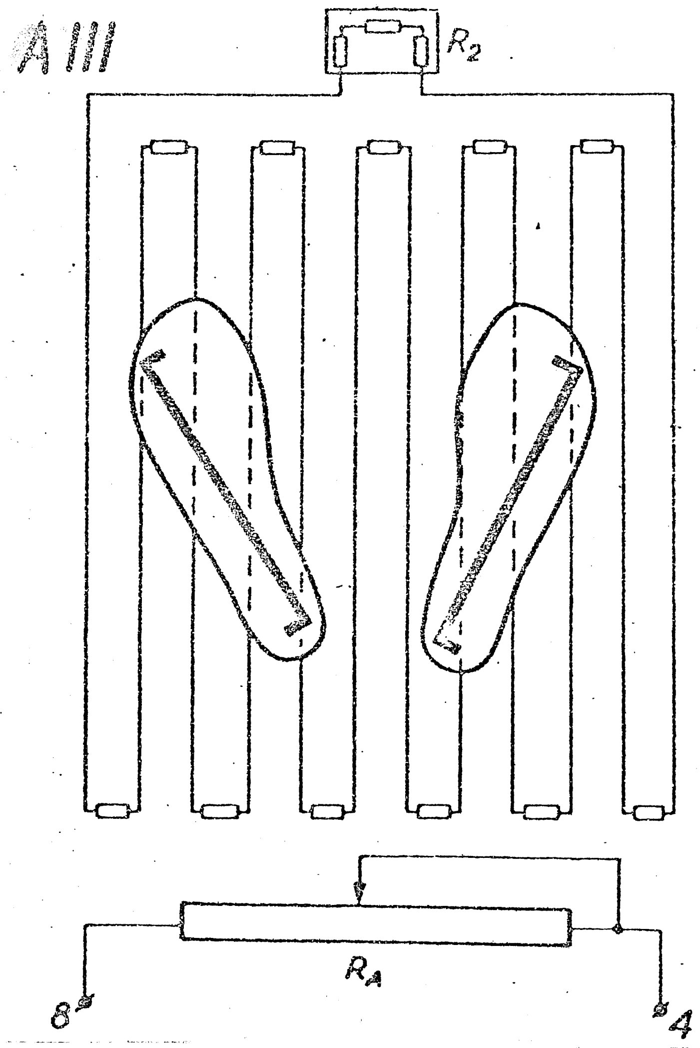

Fig. 4

Scheme A-III

The scheme is designed for the examining of the temporal and linear parameters in the process of foot-rolling-over. The footwear is made of thin leather or some other material. Lengthwise the sole has a copper wire contact. It crosses somewhat obliquely (Fig. 4). In various phases of stance the length of the wire changes (the wire is in contact with the road) and this helps to see the temporal as well as the linear structure of the foot-rolling-over process. During the single-limb process of step one can determine the angle of foot-turn.

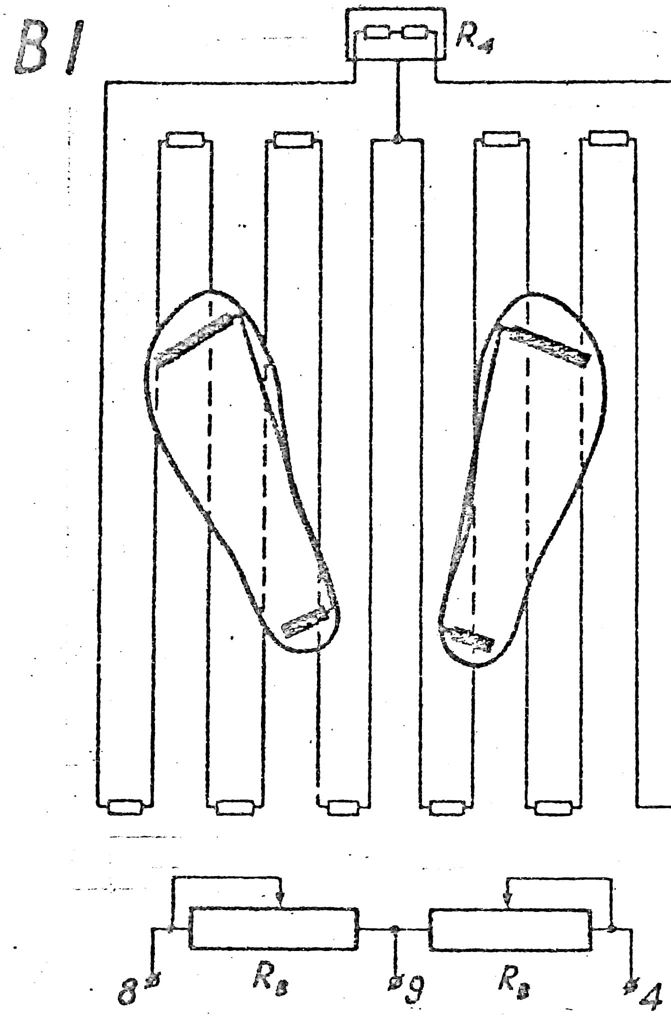

Fig. 5

Scheme B-1

The scheme is designed for the registration of the podogramm and the angle of the foot-turn (Fig. 5). The toe and heel contacts of each slipper are connected one with another. During the walk over the road contact is made in turn with the right and left part of the road. This allows a clear picture of walk on the oscilogramm with clearly separated characteristics: the characteristic of the right foot in the right of the zero line and the characteristic of left - in the left (or reverse). The scheme is good for use by in self-control of walk during the period of rehabilitation of patients after traumas and operations of lower extremity.

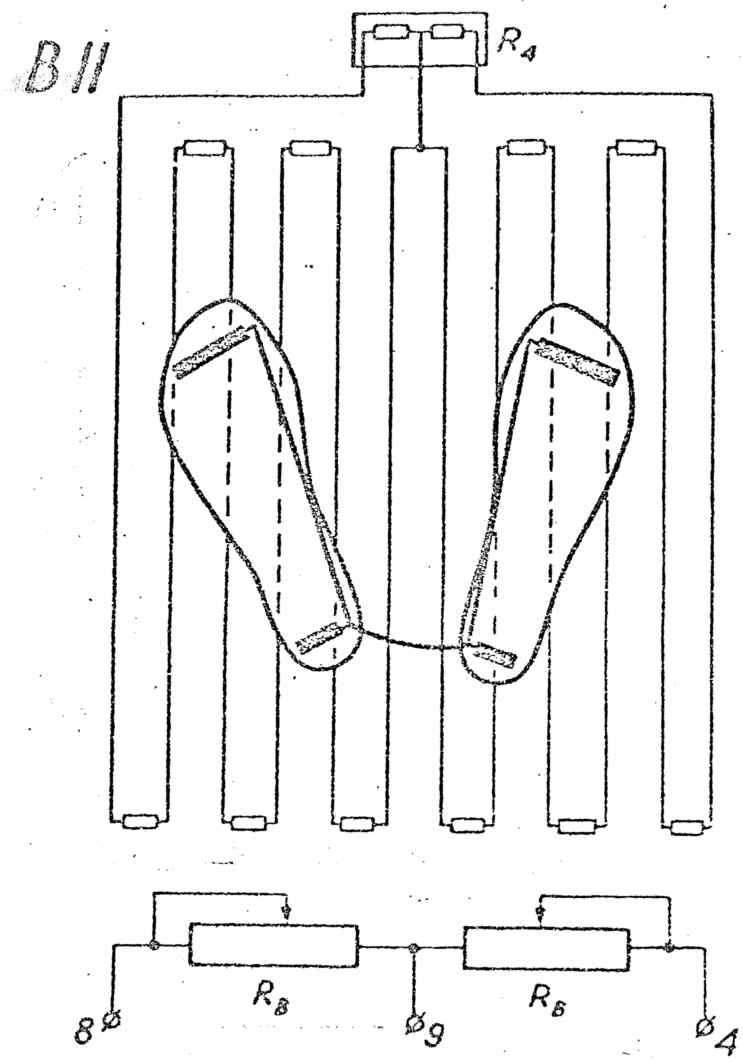

Fig. 6

Scheme B-II

The scheme designed for the registration (Fig. 6) the podogramm and for determining the straight-forwardness of walk; one can measure the angle of foot-turn. All the four contacts on the foot-wear are connected with each other.

During the two support period one can register the difference of right and left foot from the middle line. The scheme is convenient for learning the straight-forwardness of walk, especially during the period of rehabilitation and can be used for self-control of walk.

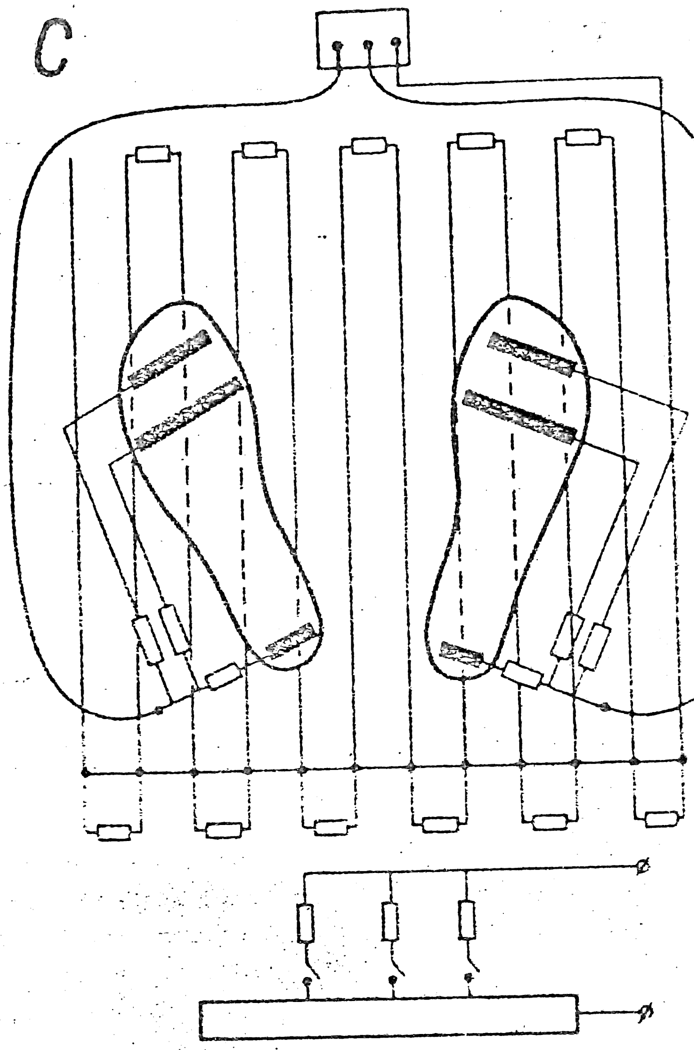

Fig. 7

Scheme C

The scheme is designed for registration of the podogramm (Fig. 7). In this scheme the road is turned into an ordinary current conducting deck, all the strings are shortened by special closers. The foot-wear used by patient has three contacts on the sole: on the front, heel and in the region of heads of metatarsal bones. Each contact is connected with a definite resistor. In difference with ordinary roads which are like smooth metalic stripes the patient is walking over a soft, thin deck, which is not slippery. This secures more natural conditions of walk which is especially important during the period of rehabilitation when the patient lacks confidence and moves with difficulty.

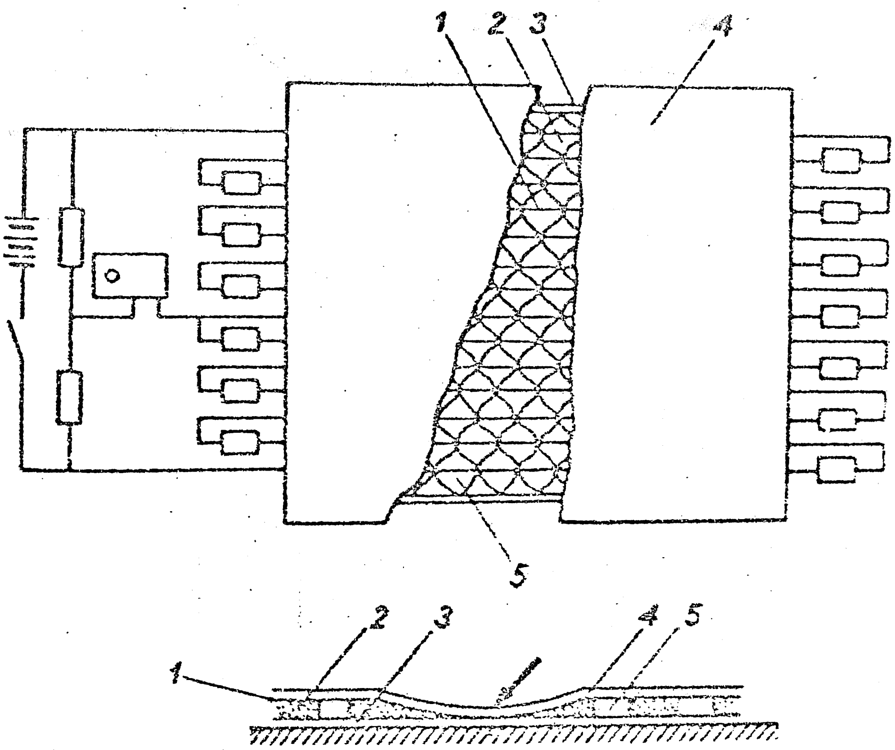

Fig. 8

Scheme E

The scheme is designed for the investigation of linear and temporal parameters of the foot-rolling-over process (Fig. 8), the patient may not have foot-wear. The scheme of the road can be as in type A or type B. What is different is the way of closing the current-conducting strings. Contacting layer 3 is put under the strings of road 1. In the unloaded state they are not contiguous, as they are parted by a layer of insulating material 2 with openings 5. From above the strings, are covered with an ordinary carpet road 4.

Scheme F

The scheme is designed for the investigation of the mutual location of various parts of body and the support surface of the foot. After the scheme (Fig. 9) the strings of the road 1 together with resistors 2 by their input are joint with one of the main points of the bridge which consists of a pair of constant resistances 6, one variable resistance 7, balancing resistor 5 and a section of the road which may be joint up to slipper's sole.

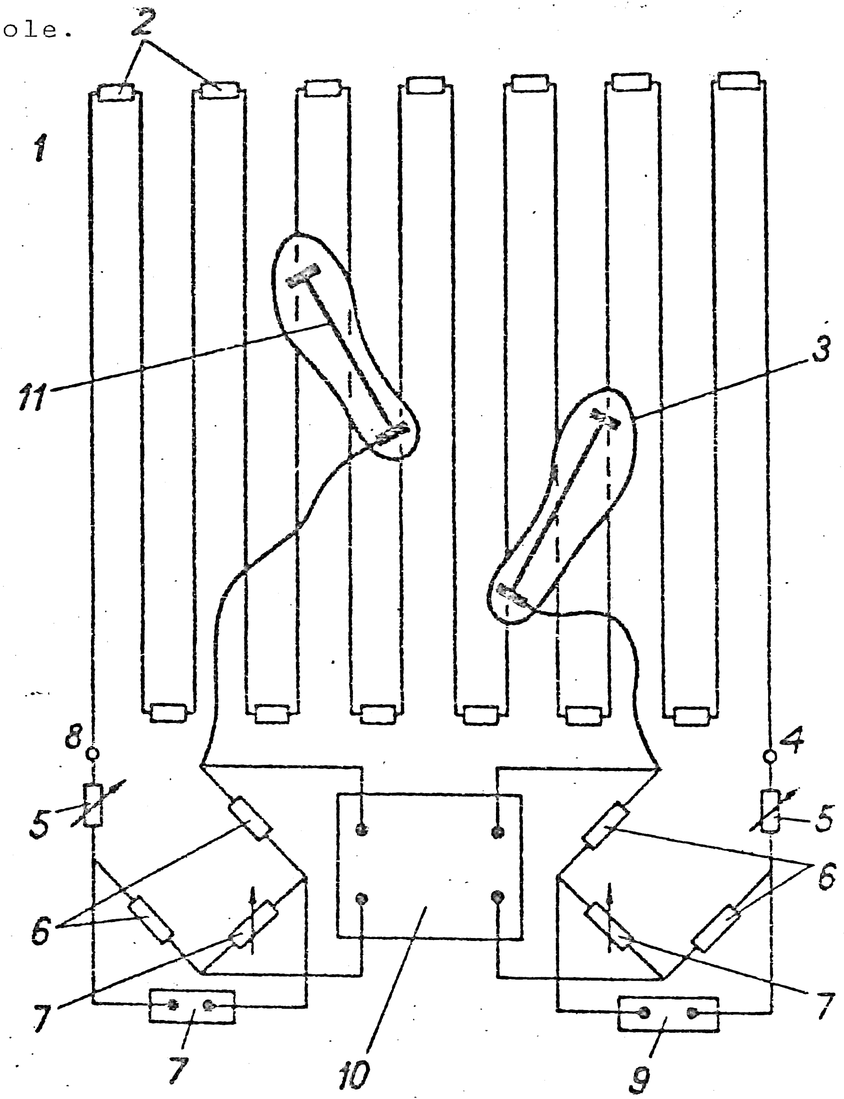

Fig. 9

This scheme gives the location of the support foot. On the vertical plane parallel to the plane of the supposed transference of the patient there are set longitudinal lateral strings placed at a different height (Fig. 10). Each string is connected with the input of the inductance gauge. To the second input there are joined up electrodes, which one can fix on the patient's foot at points which you may measure. While the patient walks, the distance to main string is measured. This scheme allows exact measurement of the spatial mutual location of selected points of the human body. The range of measurements of parameters is 0-60 cm. Precision of measurements is ±1%.

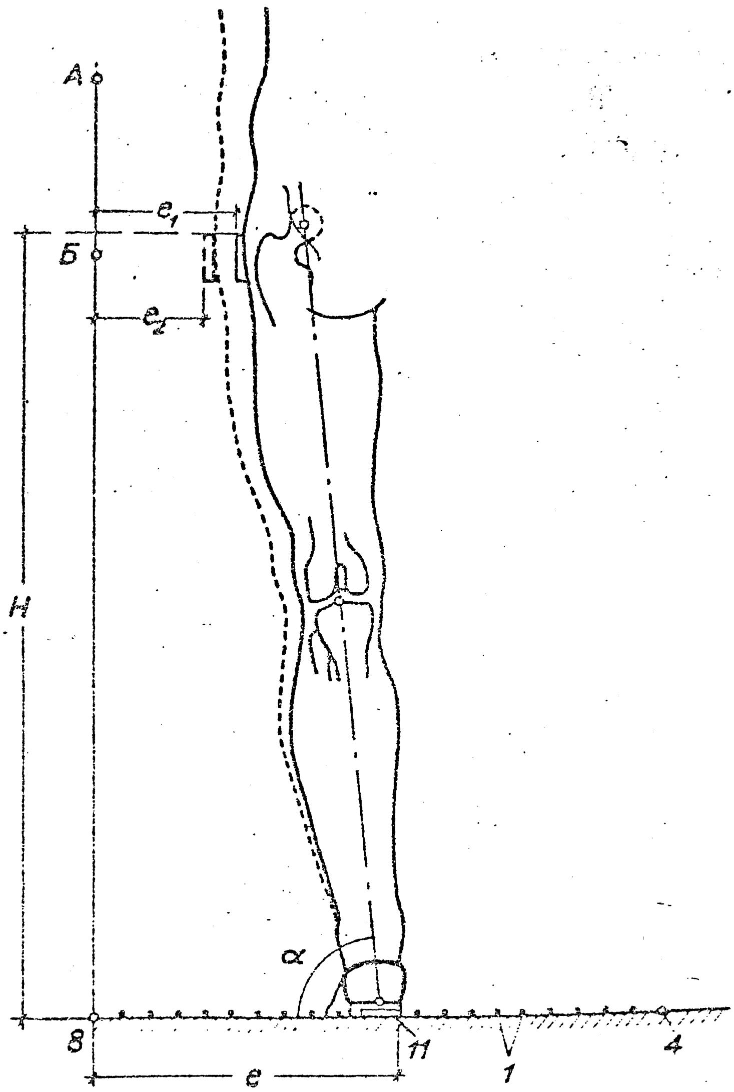

Fig. 10

Transducers of measuring the flexure and forsion of bone callus

Four channels of the basic module are designed for the measuring of the deformations of bone callus in static and dynamic conditions under the influence of given loads.

There is a set of transducers in EKIG designed for measurements of simple deformations of curve type as well as for measurements of complicated ones including the bending, shenar and forsion. For all the transducers the primary transducer is a metal girder with strain gauge transducers attached. The mechanical system allows sensitivity in combination with a wide range of measurements for 0,1 - 5 arc. Diagrams allow calculations of the degree of bones' union after fracture according to the measurements.

Fast-acting multichannel recorder

This recorder is used for the recording and storage of information on diagram paper. It has 8 channels with the maximum current of channels 1-10 mA. The internal resistance is 3500 ohms. The resistance of the external chain is from 150 to 200 ohms. The frequency of natural oscillations is from 0 to 100 cycles per second. For EKIG one can use two parallel recorders.

Loop oscillograph

For the recording and storage of information on the photographic film of 36 mm we use 14-channel oscillograph with the rate of movement of film 25-8000 mm/sec. For better computing we use colour film with a special filter for the division of curves according to colour.

Electrobeam indicator

This module in combination with the basic module is designed for the control and self-control of movement, by the reflection of guide curves. The indicator is effective feed back because it allows observing the parameters of measurement very effectively on a large screen (47 cm place obliquely). By these methods the main manifestations of pathologically changed dynamic stereotype of gait during the rehabilitation period can be eliminated.

Device of modelling of analog signals

The mechanical modelling device provides analog signals on the screen of electron indicator. These signals are designed for training the patients to correct and economise gait according to standards of indices of gait. The device is simple and highly effective.

Special foot-wear

Foot-wear is the main transducer on the test road. Various settings of the crosspieces allow collection of information about the movement of lower extremities.

On the basis of analysis of normal motor process of man's gait, of regularities of control and by making use of the possibilities of the complex device EKIG-3 a system of self-training with a quick control of the resultant motion has been devised. In the main feedback was by means of visual and auditory analysers. With that in view a system of multistage algorithms of training was worked out. The algorithms were organised in 2 main sections. The first section - the algorithms for elimination of pathologic symptoms of gait, and second - the algorithms of selection of means of elimination of definite symptoms.

Before the training an optimal algorithm for order of elimination of pathologic symptoms and a set of proper standards was chosen according to the results of the analysis of curves. The patient was informed of the aim, process and means of training. During the process of training with the degree and stability of the improvement of pathologic symptoms were determined.

The device and the system of training we can recommend for the use in biomechanic laboratories, in centres of rehabilitation of orthopaedic-traumatologic patients, neuralogic and neuro-surgic clinics, great sanatoriums and biomechanic sports' laboratories.

A Force platform constructed at The Research Centre "POLSPORT"

By

Maciej Piatkowski M.Sc,Eng,
Research Centre "POLSPORT"
Warszawa-POLAND.

Describing of the force platform for biomechanical research providing the measurement of the 3 orthogonal components of one dynamic force.

Platform has a high frequency of the self vibration and a high rigidity, of course.

By application to the construction special integra transducers, we reached separation of the measure of forces.

Platform was constructed specially for the measure stand for modelling of the biomechanical systems and computing the forces in the joints of the human body.

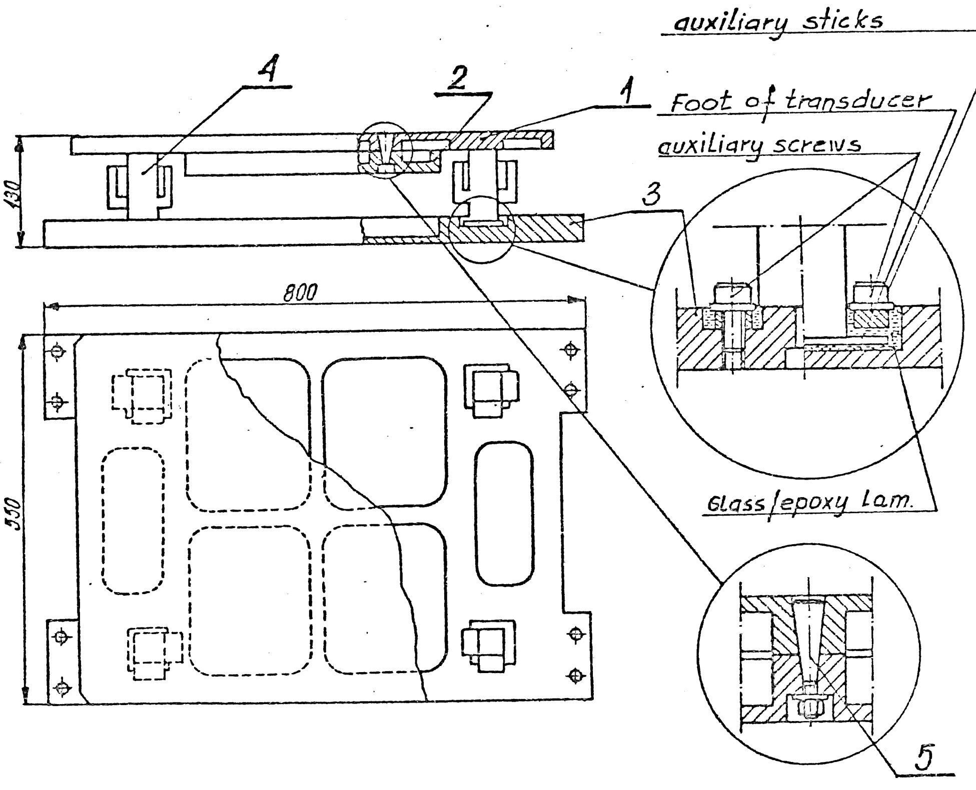

Fig. 1 Force platform PT-1

Fig. 1 shows the details of the platform PT-1, constructed in our Centre. Dimensions of the structure are: 800 mm length, 500 mm width and 130 mm high.

The mass is 31 kg, but the mass of the upper plate is 7.65 kg only.

The high rigidity of the upper plate is reached by the construction of the "closed" structure in the middle of the plate /1/. using steel bolts /5/.

Upper plate, lower plate /3/ and auxiliary plate /2/ have one-side honey-comb structure, made in aluminium composition

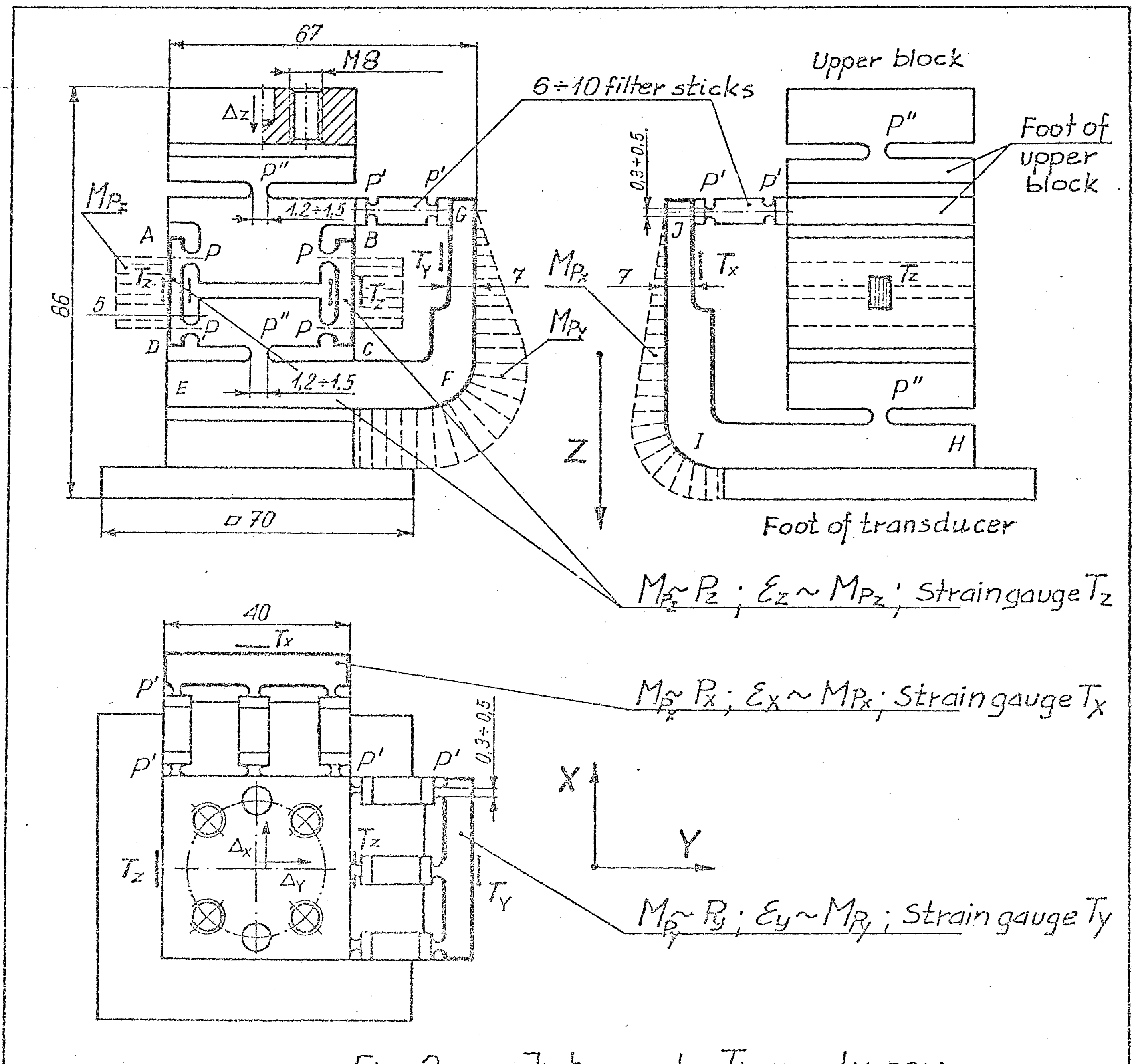

Fig. 2 Integral Transducer.

PA 6 and PA 7, with destruction stress point $_{r} = 270\frac{N}{mm}$ and $_{r} = 300\frac{N}{mm}$ respectively.

Transducers

Fig. 2 shows the integral transducer /4/ of force and main dimensions. The construction of the transducer provides full natural separation of components of dynamic force and high rigidity.

By an application of the spring joints /P,P'and P"/ and special filter sticks, with 4 P' joints in crossed vertical/ horizontal positions high quality of the measures was reached.

Material of the transducers - steel CVM /Chrom, Vanadium, Mollybdenium/ was hardened to 40 HRC degree and stabilized.

Transducers are fixed to the upper plate by screws, but to the lower plate by laminating/glass-epoxy component/.

Measurements ranges of the platform:

0-10 000 N in perpendicular direction

1- 5 000 N in horizontal directions/orthogonal/

The frequency of the self vibration in perpendicular Z direction is 310 Hz, in X direction - 257 Hz, in Y direction - 234 Hz.

The different values of the self vibrations and filter sticks, gives the filter effect in vibration energy transmission, specially in the case of the one-directional impulse.

It is easy to understand this effect, when one can measure the vibrations in Y and X directions in the case of Z impulse, when Z vibrations should be noted only.

Integral transducer is free of energy transmission effect, in comparison to other transducers in well known force platforms.

Platform will be used for the measurement of forces in sport.

Problems of errors

In February of 79 we should make full dynamic characteristics of the platform for 3 types of transducers.

This comparison should allow to find the compromise between technological problems of transducer and quality of measurements.

For an integral trasducer we will find stiffness, k, k', k". dumping C, and reduced masses M_t coefficients, what should allow to find coefficients of errors of amplitude and phaze angle of dynamic force.

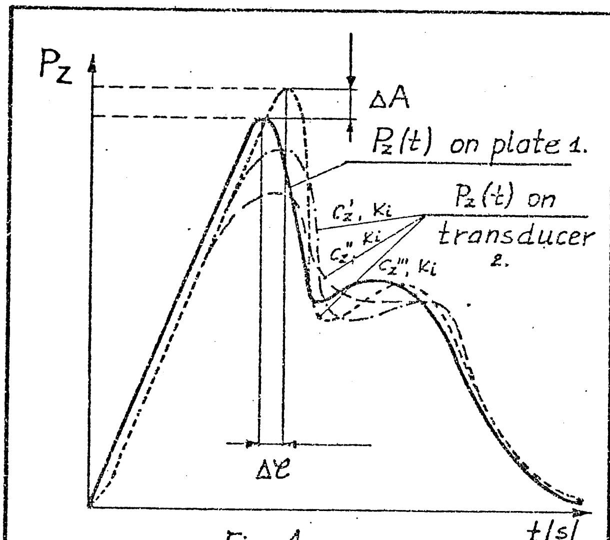

Fig. 4

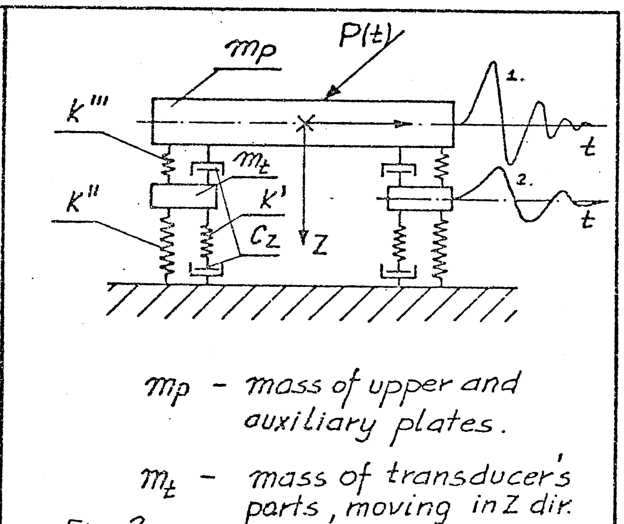

Fig. 3

Fig. 3 and 4 show the idea of the error problems for Z direction . In March of 79 we should make first modelling "session" in the Warsaw Academy of Physical Education.

We will work on jumps patterns there.

Next, we should describe the human body movement using analog computer and 5 basic mechanical simple models.

The Force Platform Group

International Society of Biomechanics

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Please complete and return this form with US $5 (or equivalent), being subscription fee for 1979, to Barry Wilson,

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Australia.

Dear Colleague,

In the 4th Newsletter was included a register, or list of members and their research interests. In order to update this register would you allow me to publish brief details of your work. Please complete the questionnaire below and return to me as soon as possible.

1) Name ....
2) Title (Mr, Mrs, Ms, Dr, Prof, etc.) ....
3) Address ....
....
....
4) Institution (if different to above) ....
....
....
5) Do you work with a force platform? Yes ______ No ______
6) If answer is No please give reasons for your interest:-

____

____

7) Please give brief details of your platform or platforms
Type ....
Transducers ....
Size of top surface ....
Recorder ....
Other ....
8) What auxilliary equipment do you use? (e.g. E.M.G., cameras, etc.)
....
9) What are the main lines of your research? (e.g. sports techniques, gait analysis, etc.) ....
10) Please list any relevant publications by you which have not been included in Newsletters 1 and 2. (Attach additional sheets if necessary).

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Many thanks for your co-operation.

Yours sincerely,

Barry D. Wilson,
Secretary F.P.G.