operational circuit characteristics. When selecting "The Parts List" record the user can select any circuit element and obtain the technical conditions file for this.

So far, while operating the hyper-text system the designer or technologist disposes the handy and fast ability to find, load, view or modify the current designing document.

REFERENCE

[1] http://www.win.tue.nl:80/win/cs/is/debra/cursus/review-1.html.

[2] Engelbart D.C. // Comm. of the ACM, August 1995,/Vol.38, No.8, P. 30-32.

[3] Hofman F. // Wirtschaftsinformai, 1991, Heft 3. S.177-185.

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MECHATRONIC MICROSYSTEMS INTEGRATED IN MEASUREMENT TRANSDUCERS AND INTELLIGENT EQUIPMENTS

The paper presents mechatronic microsystems integrated in measurement transducers and intelligent equipments realized in National Institute of R&D in Precision Mechanics.

1. POSITION PHOTOELECTRIC INCREMENTAL TRANSDUCER – TIRO

Rotation incremental transducers – TIRO (fig. 1) are designed and realized in an original conception in several typo-dimensions, adequate to a large game of applications.

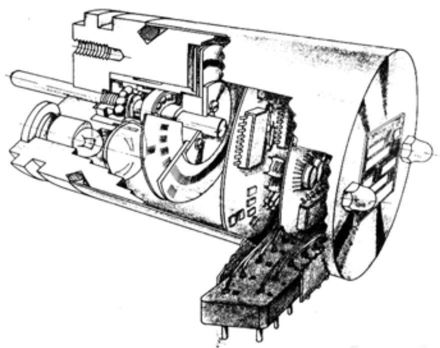

Fig. 1

Built on the structure of a slide projector photoelectric incremental system, TIRO transducers supply, mainly 50, 100, 250, 500, 1000, 1024, 1500, 2000, 2400, 2500, 3000, 3600 electrical impulses on 360°, that way converting one analogical entrance measure into an digital exit measure. Based on cinematic-electronic chart from figure 2, we consider: the divisor disc (1) is the support of a radial incremental network with constant step and the ratio transparent zone/ opaque zone, equal to 1.

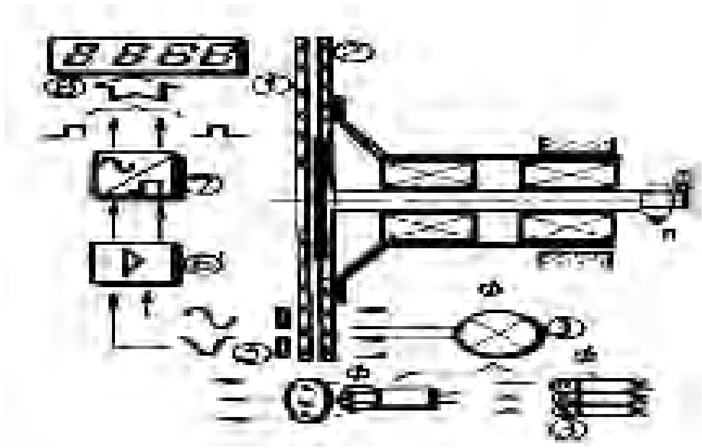

Fig. 2

If the vernier incremental disc (2) contains 4 identical network zones.

Entrance measure, S_i, applied to shaft (4), produces the modulation of radiant flow, so the emergent flows of the 4 incremental radial networks have periodical variation (triangular) being temporary dephased in quadrate.

The photo-elements (5) are applied in "push-pull" to operational amplifiers that represent the amplifier level (6), in this way minimizing the influence of the temperature and eliminating radio-electronic parasites at this level.

The formatore level (7) composed of bistables and reversors supplies at exit 4 right-angled signals in quadrate (TTL for non-perturbing environments and small or open-collector for environments with parasites and distances until 50 m).

TTL exits provide perfect compatibility with calculus technique.

Main technical-functional characteristics:

- resolution: 36";
- measurement interval: 0°÷360°;
- axial force: 10N;
- redial force: 20N;
- supply: (5±0,25)Vec;
- maximum revolution: 9000 rot./min.;

2. SMALL MOVEMENTS TRANSDUCERS WITH PHOTOELECTRIC INCREMENTAL SYSTEM OF POSITION TYPE TID (BREVET NO. RO/92178)

Small movement transducer with photoelectric incremental system of position type TID (fig. 3) was conceived and realized in three typo-dimensions: TID-R-10; TID-R-30; TID-R-50.

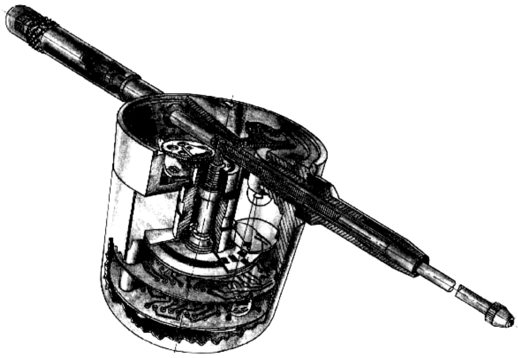

Fig. 3

Based on figure 4, it is represented the cinematic-electronic scheme, to emphasize only the supplemental constructive elements in comparison with the feeler (1) on which it is exercise the entrance measure (S_i).

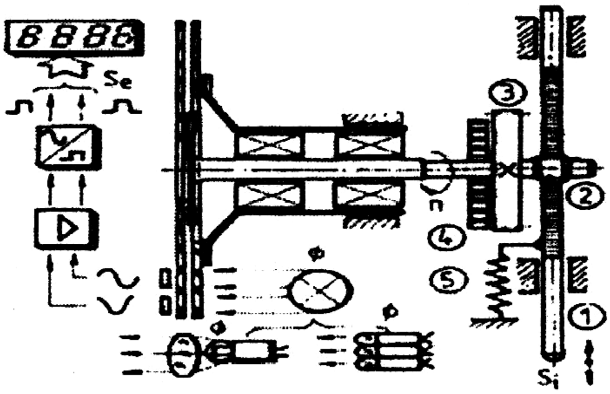

Fig. 4

That drives the transducer shaft through pinion (2). The wheel (3) and the spiral plan arc (4) provide the contact on the same flank of dents.

The helicoidal arc (5) induces the measurement force.

The transmission ratio rack bar-pinion is established so any electrical impulse supplied by the photoelectric transducer is tantamount to a movement Si=0,01 mm (and respectively: 0,001 mm).

Main technical-functional characteristics:

- measurement interval: (0 ÷ 10) mm ÷ (0 ÷ 100) mm;
- resolution: 0,001 mm;
- accuracy: ± 0,001 mm;

3. DIGITAL MICROMETRIC HEAD

The digital micrometric head (fig. 5) is realized with rotation microsystem photoelectric incremental based on brevet no. RO/92176.

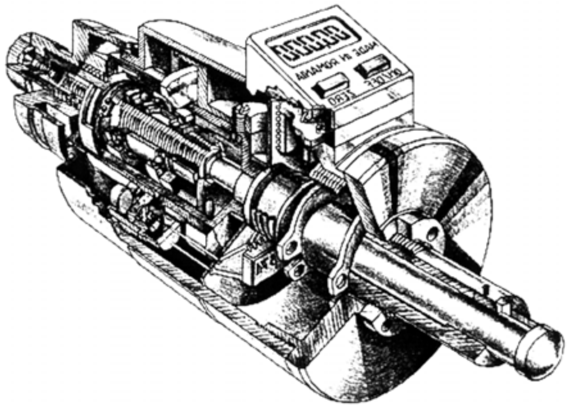

Fig. 5

Based on cinematic scheme presented in figure 6, rotation movement from tambour (1), is transmitted to micrometric nut (2) which is radially beard and axial with precision microbearings front to the body. Solidary with micrometric nut is fixed the incremental divisor disc (3).

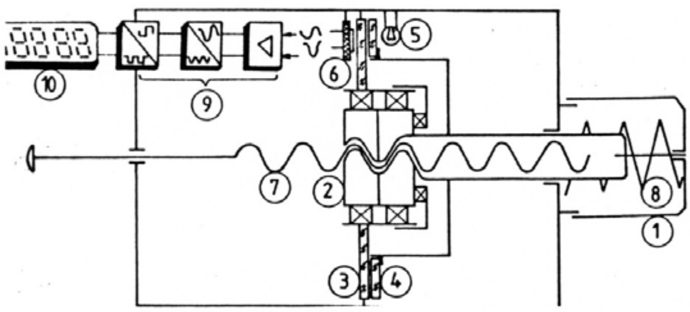

Fig. 6

Stiffened on apparatus body there is the incremental vernier (4) and the illumination microsource (5).

The light flux scanned in relative movement of the two incremental discs is catch by a group of photo elements (6).

The nut rotation is transformed into a linear movement of the micrometric screw (7), which takes over the rotation front to the body through a cylindrical pin which glides on a longitudinal channel practiced in micrometric screw spindle.

Between the operation tambour and micrometric nut there is a helicoidally twisting arc, measurement force (8).

The photoreceptor elements generates two sinusoidal signals, which are taken over by the electronic scheme of amplification – formation (9) and transformed in digital signals of logical type (TTL) and impulses, numbered by a electronic block (10) and digitally displayed.

Main technical-functional characteristics:

- measurement interval: 0 ÷ 35 mm;
- resolution: 0,002; 0,001 mm;
- accuracy: ± 0,001 mm;
- measurement force: 500 ± 50 cN;
- protection: IP55;

4. DIGITAL ELECTRONIC CRANK

The digital electronic crank (fig. 7) is realized with rotation incremental photoelectric microsystem, which is being implemented on machines-tools with NC and CNC.

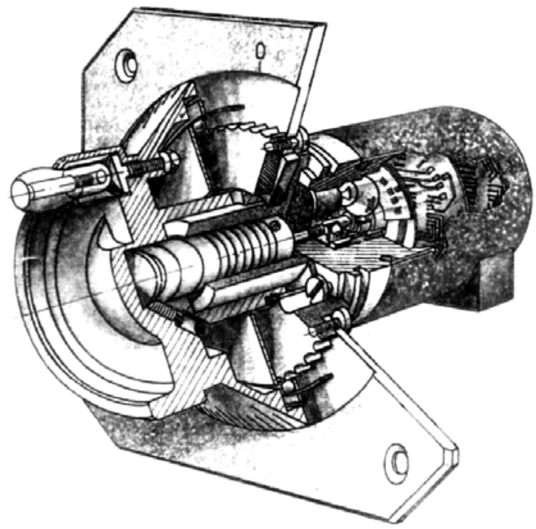

Fig. 7

Based on cinematic scheme presented in figure 8, the crank contains the gradated tambour (1) assembled on a tubular bearing with flange (2), that being fixed on a intermediary plate (3).

Rotation movement printed manually to the tambour is transmitted to the shaft (4) through the helicoidally coupling (5), that taking over any radial deviation, axial and angular of transducer ax to the intermediary shaft (6).

The gradate tambour adjustment (1) to transducer reference (null impulse) is made by reducing the nut (7) that is pressing the pincers on intermediary shaft (6).

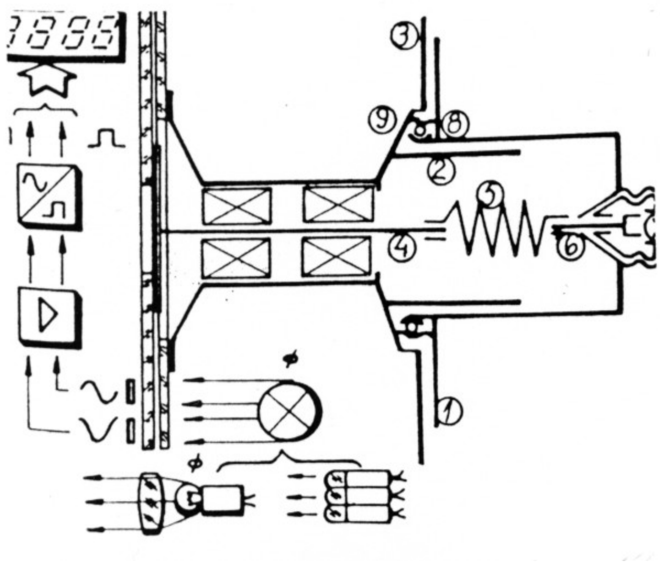

Fig. 8

In this way, the intermediary shaft it is bringing in position adequate to the beginning of graduated scale on tambour.

The electronic crank has the possibility of mounting on any machine-tool.

Main technical-functional characteristics:

- number of impulses on 360°: 1000; 1024; 2000; 2500; 3000 impulses / rot.;
- deviation from number of impulses / 360°;
- repeatability of indication displayed: max. ± 1 impulse / rot.;
- friction couple at tambour: 0,4 ± 0,1 Nm;
- protection degree: IP55;

5. OTHER INTELLIGENT MEASUREMENT EQUIPMENTS

5.1. Movement photoelectric incremental transducer (figure 9 and figure 10)

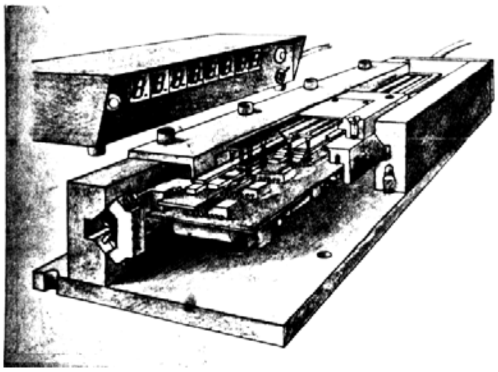

Fig. 9

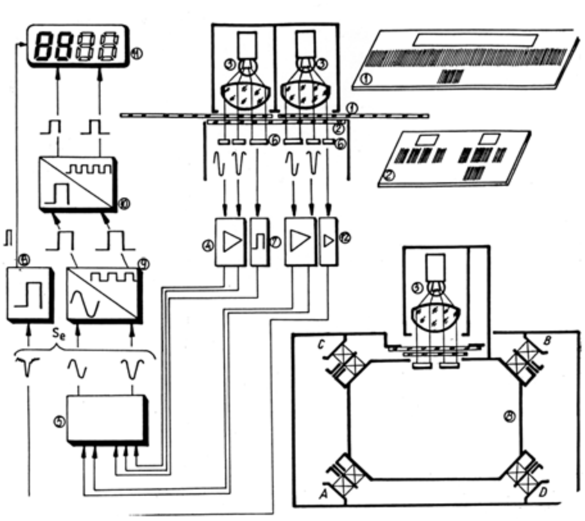

Fig. 10

Main technical-functional characteristics:

- measurement interval: 50; 100; mm;
- resolution: 0,001 mm;
- supplying transducer: (5 ±0,25) cc;
- maximum movement speed 0,5 m/s;

5.2. Measurement equipment in two coordinates (figure 11)

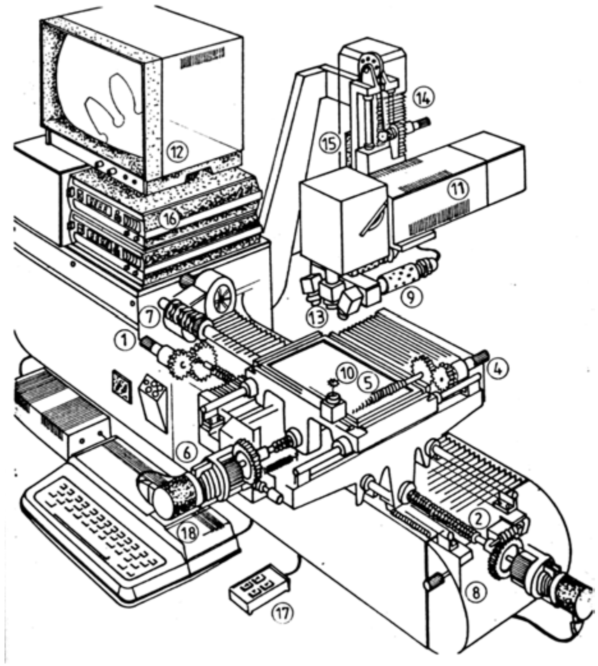

Fig. 11

Main technical-functional characteristics:

- measurement interval: x = 260 mm;
  y = 136 mm;
- resolution: 0,001 mm;
- supplying equipment: 220 V ± 10 % 15 %;
- maximum movement speed 0,5 m/s;

5.3. Minirobot of dimensional control with five liberty degrees (figure 12 and figure 13)

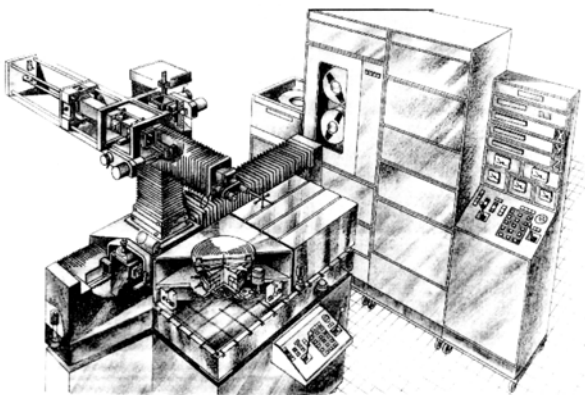

Fig. 12

Main technical-functional characteristics:

- measurement interval: x = 700 mm;
  y = 450 mm;
  z = 300 mm;
  $\varphi_1 = n \cdot 360°$;
  $\varphi_2 = \pm 180°$
- resolution: 0,001 mm;
- liberty degrees: 5
- fidelity error: ± 0,0025 mm;
- bearings: gazostatic.

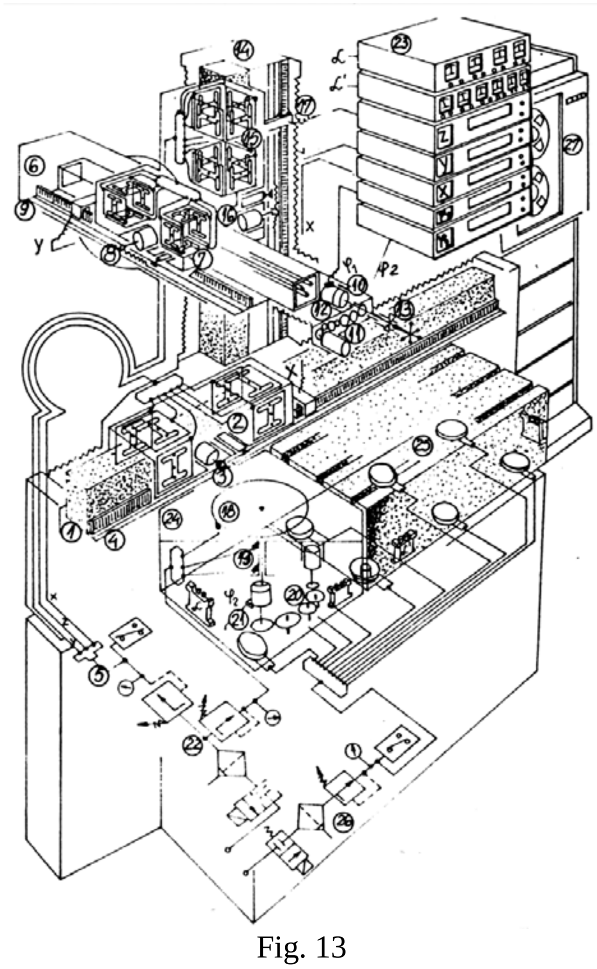

Fig. 13

6. REFERENCES

6.1 Isermann, R, Raab, U. Actuator principles with low power

6.2 Acar, M., Parkin, R. Engineering education for mechatronics. 1996, IEEE

6.3 Practical control Enhancement via Mecatronics Design – James R.Hewit, Kaddour Bouzza-Marouf

6.4 The Age of mecatronics – M.Okyay Kaynak

6.5 On the Design and Control of Mecatronic Sistem – A Survey, Rolf Isermann

6.6 Traductoare pentru automatizări industriale – G. Ionescu, R. Dobrescu