DETERMINING THE WEAR OF ACTIVE ORGANS FOR PROCESSING SOIL DEPENDING ON THE WORKING DEPTH

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ABSTRACT

This paper *presents the experimental researches performed in laboratory stand, for finding out the wear resistance of a working part of chisel type, by different materials, in a certain time, for enhancing the span of life of those knifes.*

INTRODUCTION

The soil is a natural body traits, fertility, formed by the action of creatures long and climatic factors on the rocks of the mineral from the land surface. Earth ensures food products, raw materials for industry and not least, unsuspected energy. Soil is support human life and welfare. Life on the planet, soil, atmosphere, water and landforms have developed together. Nothing would be the same without the others [2,3].

Because these working parts are subjected to variable stress of rather high values, the wear intensity being much bigger in comparison with the other parts of the machine, they are also called high wear parts [4, 5, 6, 7].

Harder the soil particles are, more abrasive soil becomes [9], many times the particles hardness being higher than that of tools; thus, are determined the premature wear of the tool, modification of its geometry, especially of its blade, fact that leads to increased working resistance and high energy consumption. [3].

Researches performed in [4] have shown that there are 2 main forces acting on active parts: friction and knocking. These forces action determines the appearance of wear, that manifests as two distinct aspects: friction wear (slipping) and impact wear (knocking)[1].

MATERIAL AND METHOD

In order to test the soil working tool in laboratory, a testing stand, wholly achieved by Mechanics University from Cluj, was used. It (fig. 1) allows to test in laboratory the different working tools, by changing their functional parameters, respectively the working depth, relief angle, lateral angle to forward direction, rotative speed and respectively, according to necessities, granulation and moisture of testing environment.

By its overall and functional dimensions the stand allows to test the tools on a circular trajectory with diameter ranging between 1700 and 2000 mm at a maximum depth of 900 mm. Stand achieved comprises the following:

- Electric driving engine (three phase asynchronous, 720 rpm, 3.2 kW);
- Transmission through belts with spare wheels;
- Moment transducer (Hottinger Baldwin Messtechnik (HBM) - T30F N)
- Driving device for four tools;
- System of data acquisition (H BM - Spider 8 or National Instruments - D AQPad 1200);
- Inverter (12V/230V);
- Battery (12 V, 45Ah).

Fig. 1 Testing stand for soil working tools

Within the assembly port tool (fig. 2) the following movements are possible [8]:

- Rotation of port tool system reported to driving cross arm-adjustment of lateral angle of tool comparatively to forward direction, ±70° with 5°pace (fig. 2, movement A);
- Vertical movement of port tool bar (adjustment of soil processing depth, maximum 50 0 mm at pace of 50 mm) – (fig. 2, movement B);
- Rotation of port tool plate – adjustment of tool relief angle (fig. 2, movement C);
- Vertical movement of transducer assembly – adjustment of force ratio between the real one and the measured one (fig. 2, movement D).

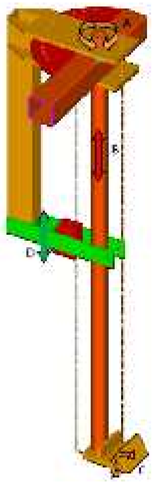

Fig. 2 Port tool assembly

Fig. 3 Port tool

In order to test the working tools designed and achieved, a suitable port tool support had to be performed. (fig.3). Device was designed and manufactured so that it allows to mounting it on the existing stand, adjust the working depth within the limits of real working depth and entering angle. In consequence, the port tool (fig. 3, 4) allows the adjustment of the entering angle in 5 steps end working depth.

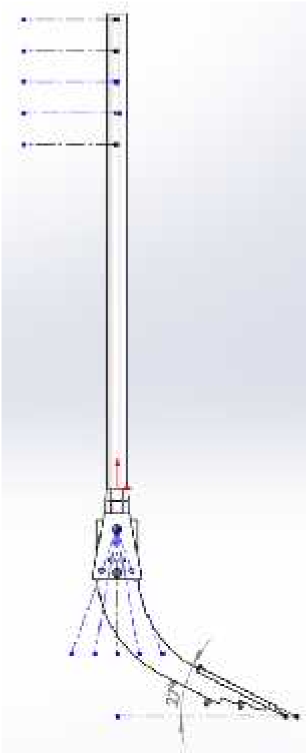

Fig. 4 Adjustment of the port tool entering angle end working depth.

RESULTS AND DISCUSSIONS

All the settings on stand allow a good coverage of tools working possibilities, endurance tests for determining the tool wear using specific measuring installations.

For tests, a chisel support (fig. 5) and 3 chisel knives made of different materials OLC 45 (a), OLC 45 thermally treated (b), OL 50 (c) (fig. 6), were used

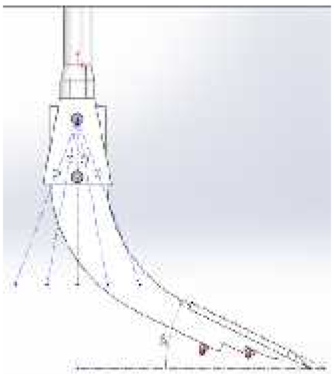

Fig. 5. Chisel support

a) b) c)

Fig. 6. Chisel type knife a) OLC 45; b) OLC 45 thermally treated; c) OL 50

Those 3 knives were mounted in row on the testing stand (fig. 7), at a depth of 22 cm and set to work in the in sand of stand, so that their wear could be determined after a certain number of operating hours.

Fig. 7. Chisel type knife mounted on experimental stand

In the first phase chisel knives were weighed using a precision scale (fig. 8), then one by one was mounted on the test bench, where they were allowed to work for one hour. After each hour of work in stand were dismantled and each process that was repeated 7 times for each knife, aiming wastage material through attrition (table 1).

Fig. 8 Weighing chisel knives

Table 1

List of data obtained for chisel type knives subjected to wear analysis depending on the material of which has been made

Time [h]	Chisel type knife OLC 45 (1)		Chisel type knife OLC 45 thermally treated (2)		Chisel type knife OL 50 (3)	
	Initial weight [g]	Mass difference (effective wear) [g]	Initial weight [g]	Mass difference (effective wear) [g]	Initial weight [g]	Mass difference (effective wear)[g]
0	259.52	0	257	0	238.16	0
1 h	259.1	0.42	256.47	0.53	237.89	0.27
2 h	258.77	0.33	256.18	0.29	237.65	0.24
3 h	258.43	0.34	255.99	0.19	237.44	0.21
4 h	258.12	0.31	255.78	0.21	237.3	0.14
5 h	257.78	0.34	255.6	0.18	237.18	0.12
6 h	257.52	0.26	255.44	0.16	237.02	0.16
7 h	257.27	0.25	255.3	0.14	236.84	0.18

This has led to the evolution of wear over time (Fig. 9) depending on the material they were made chisel knives.

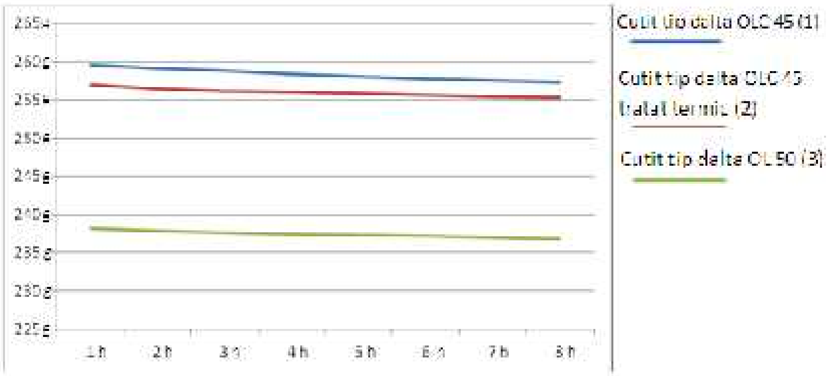

Fig. 9 Evolution in time wear the 3 knives chisel

In fig 10, we can see the evolution of wear degree growing during the 7 operating hours; thus, it can be noticed that the chisel type knife made of OL50 was subjected to a reduced wear during the operating period, being followed by chisel type knife made of OLC 45 thermally treated, and the chisel type knife from OLC 45 was the most worn up.

At the same time, one can notice that the highest wear level for all the 3 chisel type knives has happened during the first hours of operation, after which, the wear has diminished.

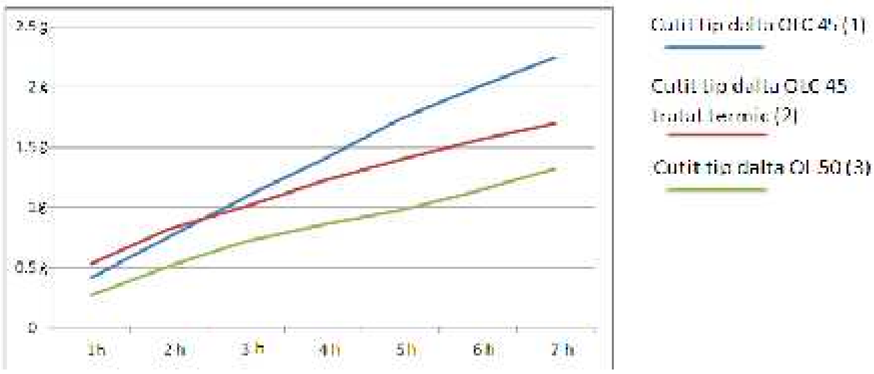

Fig. 10 Evolution of wear increasing of the 3 chisel type knives

CONCLUSIONS

In experiments it has been observed that:

- The highest degree of wear occurred in the first period after which it began to drop the knife OL50 especially, the one from OLC 45
- Knife OL50 suffered less wear throughout the operation, followed by the OLC 45 HT.
- The greatest wear at the OLC had 45

Also notice that it is very important material they are made knives for soil.

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