RESEARCH ON RECONDITIONING AGRICULTURAL PLOUGH BY APPLYING WELDING HARDFACING

Cornel TANCO, Maria HERAŞCU (ROŞCA), Camelia RADU (HANEA), Iacob-Nicolae TRIF
Transilvania University of Brasov, Romania

Abstract. The paper shows the components of agricultural utilities: plough and knives of the cultivators who suffer the wear processes during operation. These components are studied by the degree of wear and are fixed by welding technology. Article presents experimental researches on welding hardfacing, materials, technological parameters and qualitative study of hardfacing surfaces.

Keywords: plough, wear, refurbishment, welding hardfacing

1. Agriculture equipment components

Modern technology has been developed and agricultural equipments sector is leading to the replacement and improvement of traditional machines. Evolution of new manufacturing technologies has led to improved quality, reliability and maintainability of components of agricultural machines.

The main components of agricultural machines that suffer the wear processes in contact with soil are:

- agriculture plow equipment (figure 1);
- agriculture plow band blades (figure 2);
- tiller equipment (figure 3).

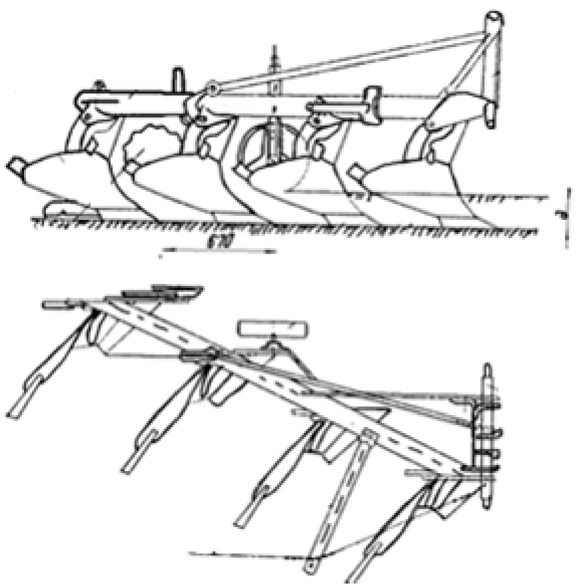

Figure 1. Agriculture plow equipment

The soil particles it contains are more abrasive hardness, many times greater than the material the tool it is made. This leads to premature wear of the tool, changing its geometry, especially the cutting part leading to large increases in resistance and fuel consumption.

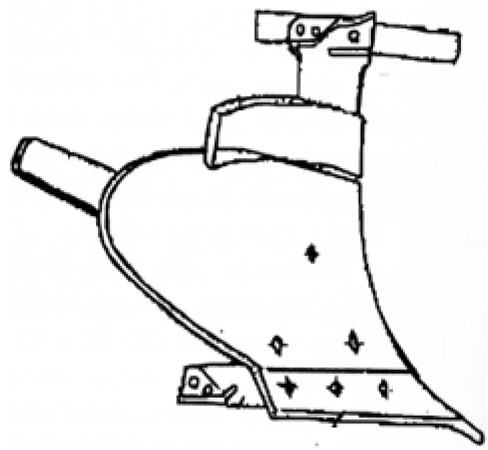

Figure 2. Agriculture plow band blades

Figure 3. Tiller equipment

In figure 4 are presented the causes of removal from service of machinery.

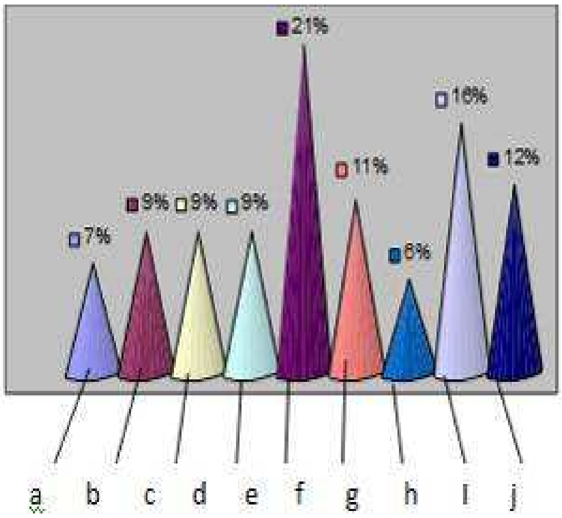

Figure 4. The reasons of machinery decommissioning

It is found that 59% are caused by improper operation causes such as:

- Inadequate work rate 9%, (b);
- Improper maintenance, 9%, (c);
- Misuse, 12%, (i);
- Incorrect initiation 16%, (h);
- Untrained personnel 6%, (g);
- Other reasons 7%, (a).

Technical deficiencies contribute a percentage of 41% consisting of:

- Wear, 11%, (f);
- Overstressing 21%, (e);
- Other causes 9%, (d).

Aging process of agricultural plough occurs after interaction with the ground due to external forces encountered like resistance and traction.

Tensile strength of the soil as with other soil processing equipment is determined by several factors, the most important being the following: physical and mechanical properties of the soil, mass of equipment, speed, grinding degree of the cutter.

Tensile strength for cultivators is a sum of components: the resistance to displacement of the soil, the resistance to cutting and deformation of the soil and the resistance to lateral movement of the furrow.

2. Reconditioning technique

The main methods of hardfacing and reconditioning by welding are:

- Arc welding hardfacing and refurbishment using tube coated electrodes;
- WIG welding load and refurbishment;
- MIG/MAG welding loading and reconditioning;
- Plasma welding hardfacing and restoring;
- Semiautomatic welding hardfacing and restoration of flow in the state.

Currently the vast majority of welding hardfacing electrodes is made of solid metal rods coated by applied pressure. However many years ago in the early stages of weld metal rods were made with tubular electrodes coated by applied immersion and their market share is much greater than solid rod electrodes.

From the construction point of view, the difference between the two types of electrodes is significant.

Today it manufactures a wide range of tubular electrodes, diameters ranging from 3.2 to 12mm, which will produce over 16 kinds of alloys for hardfacing.

Worldwide welding hardfacing most common materials are currently manufactured in the form of tubular electrodes based on metal carbides, alloy-welding matrix with Fe (steel). Metal electrodes deposited by hardfacing tube falls into two major groups of alloys as follow [1]:

- Alloys of chromium carbide;
- Alloys of tungsten carbide.

In figure 5 are presented parts of a tubular electrode of type 530 PROTECTION:

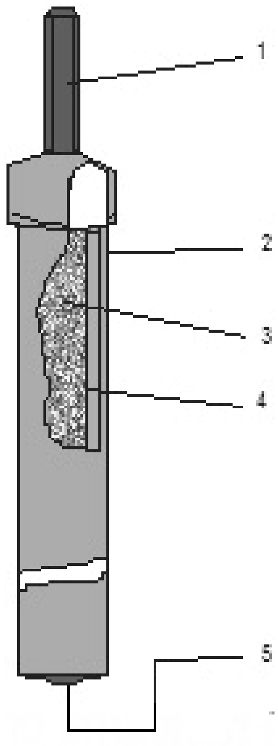

Figure 5. Tubular electrode used for hardfacing
1 – the end of the grip - color code; 2 – coating;
3 – midnight powdery; 4 – tubes steel rods;
5 – the end of primers

- Clamping end generally has a length of 20-25 mm.
- Electrodes with diameters larger than 6.0 mm are fitted with a universal mounting device (diameter 6.0 mm).

The end is marked by the electrode according to a colour code [2]:

- Thin electrode coating is applied by immersion;
- Powdery core contains alloying elements;
- Steel rod is tubular and provides the core leaks powdery;
- Primer end is graphite (by immersion) and provides a quick primer arc.

Profile of the sealing tube

In the manufacture of tubular electrodes can be used with the following profile tube closure, shown in figure 6 [3]:

- simple tube closure profile butt (a);
- tube closure profile simple overlapping edges (b);
- simple tube closure profile butt weld, the generators (c).

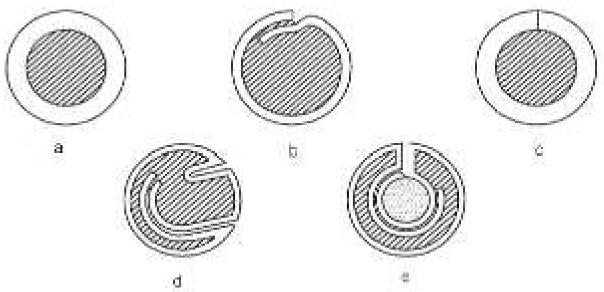

Figure 6. Types of tubular electrode sealing profiles to welded pipe, b-pipe with rolling, pipe rolling c-butt Folding d-bore, double-barrelled e-Folding

3. Experimental samples

The material used to load is a Cr-based electrode, Cr22MoV-M14 and a tubular wired with same characteristics and materials produced in the Institute of Research [4].

Chemical composition in% by mass deposited metal is like following [5]:

- prescribed 0.0-2-2, 5% C, 21-24% Cr, 0.7 to 0.9% Mo; min 0.8% V;
- determined-2, 1% C, 22.6% Cr, 0.85% Mo, 0.88% V.

Prescribed hardness: min. 50 HRC.

Determined Hardness: 55, 55, 56, 54, 56 HRC.

For the hardfacing the generator with electrode GS350 having the following characteristics was used:

Welding current $I_w = 140 \pm 10$ A;
Welding voltage $U_w = 23 \div 26$ V;
Preheat temperature $T_p = 180 \pm 15$ °C;
Temperature between rows $T_r = 200 \pm 50$ °C;
Cooling is done in calm air.

For hardfacing it is use of a tubular wire welding machine MIG / MAG Kamp mark 250 with the following features [6]:

Welding current $I_w = 180 \pm 10$ A;
Welding voltage $U_w = 22 \div 28$ V;
Preheat temperature $T_p = 180 \pm 15$ °C;
Temperature between rows $T_r = 200 \pm 50$ °C;
Ar gas flow rate Q = 14 l/min.

In figure 7 it is show a plough which was reconditioned by welding using tubular electrodes [8].

Figure 7. The aspect of a wearied plough

In figure 8 is presented the same plough after welded hardfacing operation. [7, 8].

Figure 8. Welded hardfacing plough

Figure 9 presents furrower reconditioned plough mounted and in action with the ground [8].

Figure 9. Repaired plough in action mounted on machine

4. Conclusions

The agricultural machinery parts soil assets are subject to pronounced wear that can cause damage and failure in operation for its intended objectives.

Friction processes involved in the processing of the soil are complex processes that depend on the nature of the materials used, the soil composition and operating mode.

Theoretical treatment processes for aging farm machinery leading to the establishment of operating conditions, sizing and optimal working regime relaxed.

Determination of tensile strength of the theoretical basis for growing exploitation period and the optimum duration of operation

When using reconditioned plough with Cr22MoV-M14 electrode an improvement in the work period was obtained regarding on an area of 21 ha of potatoes comparing with the lifespan of three ploughs acquired from trade in November made by OLC45 sheet.

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