EQUIPMENT FOR LIFTING AND LOWERING OPERATIONS

Dnipro University of Technology

Marchenko Kyrylo Oleksandrovych
***Supervisor:* cand.tech.science, PhD Khomenko Volodymyr Lvovych**

The equipment of the lifting complex works in the mode of repeated short-term variable loads. The process of raising a column from a well, composed of separate sections (candles), consists of cyclones "n", which contain repeated operations in a strictly defined sequence: capture of the column by an elevator; lifting of the entire column to the length of the candle under the load on the hook, which is equal to the weight of the column wife in the solution and the resistance forces during its movement in the well; installation of the column on the rotor table; relief from the load that stretches the candle raised to the surface; loosening with keys, loosening the candle from the column with a raised candle and installing it inside the drilling rig in a special store or placing it on bridges near the drilling rig; descent of an unloaded hook and elevator for capturing a column suspended on a rotor; capturing and raising the column to the length of the next candle, etc. When descending the column, these operations are performed in the reverse sequence, but with different durations and loads.

The duration of the rise and fall of each candle consists of machine and machine-manual time. The machine time of raising and lowering each candle depends on the degree of perfection of the construction of the lifting complex, its power, lifting speeds, etc.; the time spent on machine-manual operations depends on the size and weight of the candles, the degree of mechanization of this process, the qualifications of the crew, etc. From the diagrams of the cycle of raising and lowering the candle (Fig. 1), the ratio of machine and machine-manual time for these operations can be seen.

The total time spent on raising and lowering the drill string is divided into the time spent on raising the string, lowering the unloaded elevator to grab the next candle, lowering the string and raising the unloaded elevator to grab the next descending candle in the store (or time on the rise of an elevator with one pipe, captured from bridges).

The number of flights of the lifting complex (Fig. 2) during the drilling of the well depends on its depth, since it is a function of the penetration of the bit, which depends on the design of the wells and bits, the drillability of the rocks, the method and level of drilling technology, the quality of the bit, etc. Usually, for drilling deep wells, it takes from a few drills in soft rocks to several tens, and sometimes hundreds of drills in hard rocks.

As the well deepens during the drilling process, the length of the drill string is periodically increased, while the weight of the string also increases, and therefore the load on the lifting complex. The load on the lifting complex during ascent decreases as the column is removed from the well, and on the contrary, increases during descent.

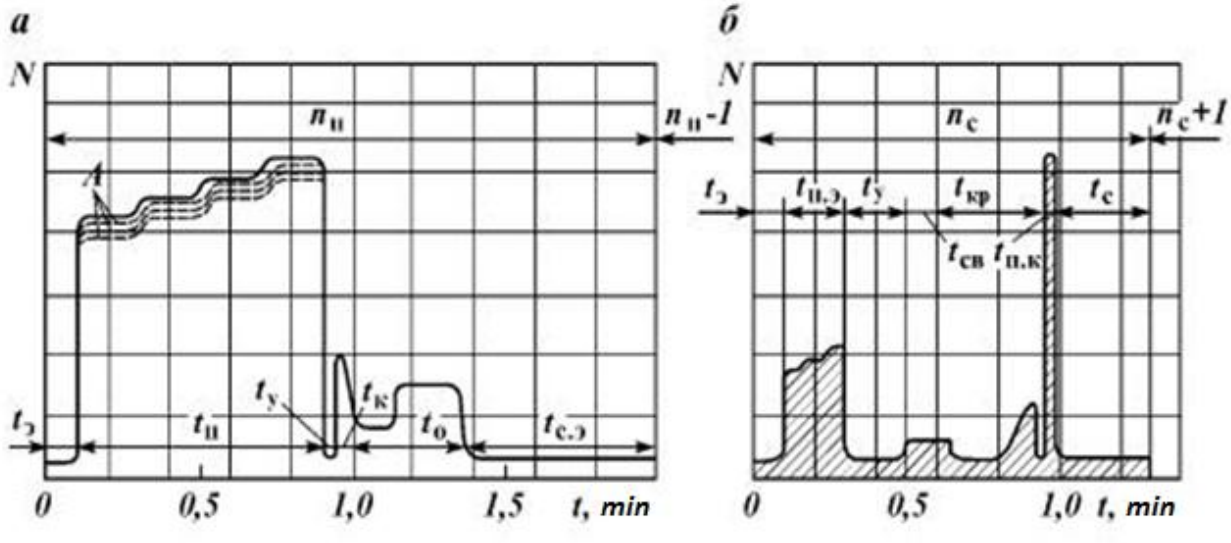

Fig. 1. Load cycle diagram of the lifting system;

a, b - respectively, the rise and fall of the column by the length of one candle:

N - power on the winch drum; t - time; te - installation or removal from the elevator column; tp.e, tp - lift of the elevator, column; ty- capture and installation of the candle; tk, t0, tzv and tkr - loosening, loosening, screwing and fastening of the candle; t PK - uplift of the column; Ts, ts .- descent of the column, elevator; And - the rise of the following candles.

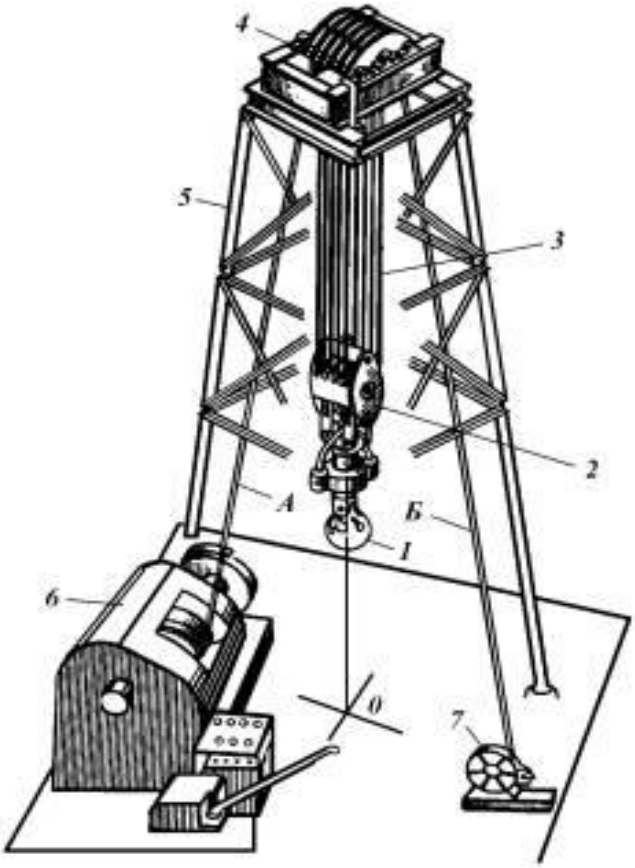

Fig. 2. Structural scheme of the lifting complex:

1 – hook; 2 - melt block; 3 - bearing branches; 4 – crown block; 5 - tower;

6 - winch; 7 - device for fastening the fixed end of the rope;

A and B - leading and fixed branches of the rope; O - the axis of the well.

The number of load change cycles on the thermal system for each flight is equal to the number of candles in the column.

Various lifting systems can be used to perform the listed functions: mechanical hoists, lever or toothed, hydraulic, etc. However, until now, designers have not been able to create a lifting system for a drilling rig that is competitive with a polyspast.

For each purpose, load and drilling conditions, the designer must find the most profitable number of branches in the system (currently, from 2 to 14 branches are used), as well as the most appropriate point of attachment of the fixed ("dead") end of the rope, because the transmission ratio depends on this and loads in the lifting system.

The hoist system of drilling rigs serves to convert the rotational movement of the winch drum into translational movement of the hook, to reduce the tension force of the end of the rope wound on the winch drum. The hoist system consists of a fixed crown block (Fig. 3, a), a movable block (swivel) (Fig. 4), a flexible connection (a hoist rope connecting the fixed and movable blocks), a drill hook and slings, on which a column of drill or casing pipes is suspended, devices for fastening the fixed end of the joint a rope that allows skipping of the rope.

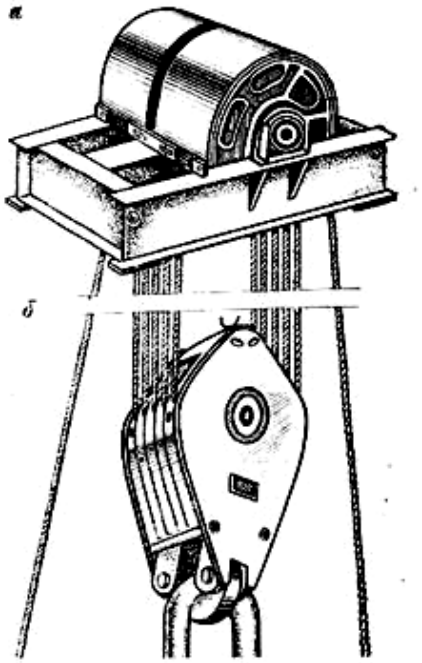

Fig. 3. The hoist system:
a) - crown block; b) - traveling block

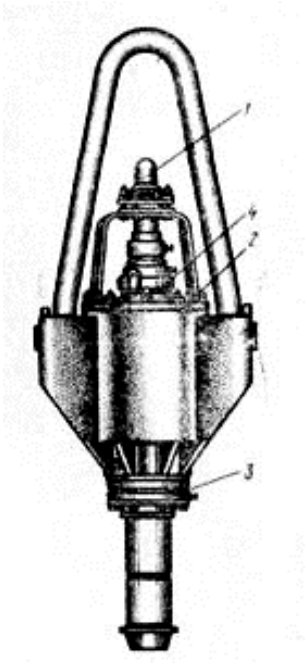

Fig. 4. Swivel:
1 – neck; 2 – upper cover; 3 – lower flange; 4 – plug with dipstick

References

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