Vortex-oscillating pump for pumping oil sludge
The Pumping out of oil products with the solids in case of overflow and accidents is quite complex and problematic task.

The Oil sludge, tar, and fuel oils are very viscous liquids and the process of transferring such liquids requires special pumps to pump the oil sludge, even in case of increase of its viscosity, at low temperatures, especially in winter.
We have gathered a large database of pumps for pumping oil sludge and their characteristics are listed below.

The absolute indices of capacity, pressure and flow of pumps are used as the main characteristics.

There are also presented the relative magnitudes:
- useful capacity (flow of pump multiply by pressure and by multiply by 0.009813);
- specific productivity (the ratio of the flow to the capacity of pump);
- relative price (the ratio of the price of pump to the max flow of pump);
- relative weight (the ratio of the pump mass to the max flow of pump).

Unfortunately, many companies give incomplete information about their pumps, so the histogram shows only those pumps, which had all the necessary characteristics.
Comparison of pumps for oil sludge in magnitude of capacity

Manufacturers of pumps for oil sludge

- Min capacity $N_{\text{min}}$, kWt
- Max capacity $N_{\text{max}}$, kWt
Comparison of pumps for oil sludge in magnitude of pressure

Manufacturers of pumps for oil sludge

- Min pressure $P_{\text{min}}$, m
- Max pressure $P_{\text{max}}$, m
Comparison of pumps for oil sludge in magnitude of flow, max flow up to 30 m³/h

Manufacturers of pumps for oil sludge

- Min flow of pump, Umin, m³/h
- Max flow of pump, Umax, m³/h
Comparison of pumps for oil sludge in magnitude of flow, max flow over 30 m³/h

Manufacturers of pumps for oil sludge

Flow of pump, m³/h

Min flow of pump, U_min, m³/h

Max flow of pump, U_max, m³/h
Comparison of pumps for oil sludge in magnitude of useful capacity

Manufacturers of pumps for oil sludge

- Blue: min useful capacity
- Red: max useful capacity
Comparison of pumps for oil sludge in magnitude of specific productivity

Manufacturers of pumps for oil sludge

- Min specific productivity: \( q_{\text{min}} = \frac{Q_{\text{min}}}{N_{\text{min}}} \), (m³/h)/kW
- Max specific productivity: \( q_{\text{max}} = \frac{Q_{\text{max}}}{N_{\text{max}}} \), (m³/h)/kW
Comparison of pumps for oil sludge in magnitude of relative price

Manufacturers of pumps for oil sludge

Relative price, rub./(m³/h)
Comparison of pumps for oil sludge in magnitude of relative weight

Manufacturers of pumps for oil sludge

Relative weight of pump kg/(m³/h)

- Relative weight of pump m=M/UMax kg/(m³/h)
Based on the histograms can be concluded that all existing pumps and equipment for the recycling of oil sludge have serious disadvantages:
- Low useful capacity;
- Low specific productivity;
- High price;
- A very low profitability;
- Short term of service.

One of the big problems - it is a very high viscosity of oil sludge. Most pumps used for pumping of oil sludge, can not cope with such a viscosity, so equipments is short-lived and quickly breaks down.

But they are used because there is no better.
Our KNOW-HOW

We offer our technology of liquefaction, transfer and disposal of oil sludge. Our technology consists in the application of very intensive vortex motion which was received by mechanical vibrations (KNOW HOW Sorokodum E.D.)

We have developed a new way to create an intense vortex motion using mechanical vibrations (without rotation of the blades, wheels, cylinders and other bodies, without a compressor, etc.).

This method of rotational motion was tested experimentally.
The following shows a general view of fluid motion in our vortex.

Left picture: particles inside the vortex rotate and simultaneously move upward, and then, by rotating, move down on the outside of vortex. Inside the vortex - emptiness.

Right picture: shows the trajectory of a particle in a vortex in more detail - except the vortex motion, the particle has also an oscillatory motion.

Picture 2. The trajectory of the fluid particles (or solid particles) in the vortex.
Picture 3. The construction of the vortex-oscillating pump.
In contrast to the well-known pumps in the world, we use a usual pipe as the pump (see Picture 4).

When submitting mechanical vibrations on the walls of the pipe (Know-how) we obtain the vortex motion of the medium which can liquefy and pump very viscous and polluted media.

**Picture. 4**
The reactor in the form of the tube (pos. 3 in Fig. 3) is provided in the vibrational motion with the help of a vibrator. Vibrating tube liquefies and pumps contaminated fluid as follows:

1. The tube of the Pump has mounted on the surface of pumped contaminated liquid (position 5 in Picture 3)

2. Vibrating pipe of a pump generate an intense vortex and the vibrational motion around and under itself.
It leads to liquefaction of viscous fluids and immersion of tube into the resulting liquefaction medium (see position 3 in Picture 3).
3. The liquefaction liquid fills the vibrating tube and gets intense vortex motion (Fig. 6).

This the rotational motion raises up the liquid (position 4 in Picture 3) while continuing her to liquefaction.
4. The Liquefaction liquid rotates at high speed. Due to this appear large centrifugal acceleration and the fluid is pumped to tube further (similar to a centrifugal pump), (see position 6 in Picture, Picture 7).
Successful results of our tests of oil sludge (received on laboratory installations)

The Oil sludge was in during 10 years. It is inactive, it is very thick liquid. Sludge treatment occurred in a vortex within 20 min.

The result:
- In a laboratory setting vortex formed from this mixture.
- Oil sludge has become a mobile liquid with a viscosity as a fluid cream, which remained in this state for several tens of days.
- Before processing the temperature of the flash point in open crucible was 170 degrees Celsius.

After processing in this reactor the temperature of the flash was 80 degrees in open crucible

Recommendations for use of our technologies:
- The intensity of treatment (level of vibration acceleration, speed, centrifugal acceleration) can be lifted several times.
- The viscosity decreases many times due to vibrations in the body of the vortex. Therefore, the energy necessary to process the oil sludge is also reduced many times over.
- Our machines can be used to produce gasoline from crude oil and the oil wastes.
The main advantages of our future vortex-oscillation pumps over analogues:

1. The intense vibration acceleration acts on the particles of the medium in the area of uploading and inside pump, which leads to the liquefaction and reducing the viscosity of the medium and the required power.

2. Inside the tube the liquid is involved in an intensive rotational and vibrational motion, which leads to rise up and simultaneous liquefaction and reduce viscosity.

3. Rotating in a tube pump, the fluid can have a very high centrifugal acceleration, which is not possible to obtain in conventional centrifugal pumps. It provides high pressure for pumping fluid.
4. The rotating elements or fixed elements in the apparatus not available. The reactor (tube) does not rotate.

5. The self-centering of the rotating mass of the treated medium occurs at all speeds of rotation of the vortex. No shafts, bearings or other equipment.

6. Pumps can be with a normal, high or low pressure.


Eight. Small size and lighter weight.

9. Simple and inexpensive to manufacture. They are made of standard components and control units.

10. Noise Level is lower than that of the motor or vibrator of the same capacity.

11. Ease of maintenance.
## Financial Plan

<table>
<thead>
<tr>
<th>Name of the stage</th>
<th>Duration of the stage, months</th>
<th>Unit cost, million dollars</th>
<th>Quantity, pcs</th>
<th>Expenses, million dollars</th>
<th>Selling price per unit, million dollars</th>
<th>Revenues from sales, million dollars</th>
<th>Profit/Loss, million dollars</th>
<th>Net profit/loss, million dollars</th>
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<tbody>
<tr>
<td>R&amp;D of pump for pumping oil sludge up to 5 m³/hour</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>0,67</td>
<td>0</td>
<td>0</td>
<td>-0,67</td>
<td>-0,67</td>
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<tr>
<td>R&amp;D of pump for pumping oil sludge up to 50 m³/hour</td>
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<td>0</td>
<td>0</td>
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<td><strong>Total R &amp; D</strong></td>
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<td><strong>0</strong></td>
<td><strong>0</strong></td>
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<td>5</td>
<td>0,007</td>
<td>0,0023</td>
<td>0,012</td>
<td>0,005</td>
<td>0,004</td>
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<tr>
<td>Name of the stage</td>
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<td>Unit cost, million dollars</td>
<td>Quantity, pcs</td>
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<td>Selling price per unit, million dollars</td>
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</table>

Profitability (ratio of net profit to all expenses), %: **389**

The ratio of cost of R & D to the serial selling price of pump up to 5 m³/hour: **222**

The ratio of cost of R & D to the serial selling price of pump up to 50 m³/hour: **57**
The graph shows that investments in pump for pumping oil sludge up to 5 m³/hour start paying off from 15 months from the beginning of investment in R&D. Profit after 3.5 years will be around 11.7 million dollars.
The graph shows that investments in pump for pumping oil sludge up to 50 m³/hour start paying off from 15 months from the beginning of investment in R&D. Profit after 3.5 years will be around 1740 million dollars.
We are looking for an investor and partner for the development of highly efficient pumps of new generation to liquefy and pumping the oil sludge:

1. Pumping of oil sludge with simultaneous decrease of the effective viscosity.
2. Separation of the oil sludge product into individual fractions.
3. Deep cleaning of solid particles and water.

Based on our theoretical and experimental research we can carry out research and development work to create the first samples of new high technology.

We are ready (for your order) to develop and manufacture special-purpose new generation pump, based on the use the vortex-oscillating effect to the development of mass production and enter the international market.
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