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Energy Efficient Alternate Hydraulic System Called TejHydroLift

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Abstract— This paper describes a new more efficient Hydraulic System which uses lesser work to produce more output. Conventional Hydraulic System like Hydraulic Lifts and Rams use lots of water to be pumped to produce output. TejHydroLift will do the equal amount of force with lesser input of water. The paper will show that force applied can be increased manifold without requiring to move meeker force by more distance which used to be required in Conventional Hydraulic Lifts. The paper describes one of the configurations of TejHydroLift System called “Slim Antenna TejHydroLift Configuration”. The TejHydroLift uses lesser water and hence demands lesser work to be performed to move the same load.

Index Terms— Alternate, Hydraulic, Energy Efficient, TejHydroLift, Lift, Ram.

1 Introduction

For more than 150 years hydraulic systems like lifts and rams have formed an important part of our life. Hydraulics is used in almost every part of our lives. For example Hydraulic lifts are widely used for transporting men to higher floors, and in multi-storied buildings, lifting automobiles for repairs in garage etc. Hydraulic Rams are used in big earth-mover locomotives, and robots and weapons and aircrafts and cars. [1]

The principle of hydraulic Lifts and Rams remain same. “You cannot squash a Liquid”[2]. In Science this principle is stated as Pascal Law i.e. “Pressure applied to a fluid is transmitted unchanged throughout the fluid”. The best way to show how this principle is used in hydraulics is to look at how Hydraulic Lifts work. Let us first see how it works. Then we will describe how we can improvise it to use lesser input to do same amount of work that conventional Lifts use to do. And then you can guess how it can revolutionize other Hydraulic Systems like Hydraulic Rams which are almost similar to them.

2 Conventional Hydraulic Lift System

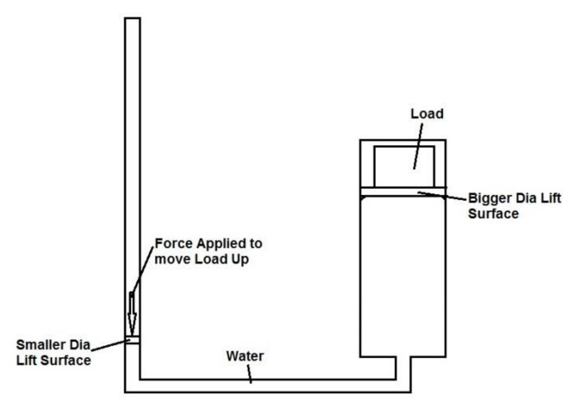

Fig. 1. Conventional Hydraulic Lift

A conventional hydraulic lift works on useing an incompressible liquid to multiply the effects of the force applied to lift something that is much heavier and larger. It makes a larger surface area require a smaller amount of applied force to do the same amount of work that was required by a smaller area but more applied force.

A hydraulic system generally contains two pistons that are connected by a tube. The pistons and the tubes are filled completely with an incompressible fluid like water or oil. The pistons in Hydraulic Lift are also typically incased in hydraulic cylinders to either raise or lower platforms for work, or other lifting devices.

Commonly used types of hydraulic lifts are table lifts, positioners, dock lifts, personal Lifts, tilt table, fork lifts, pallet lifts etc.

Let’s look at Figure 1. Conventional Hydraulic Lifts in a typical configuration have two connected cylinders with differing Diameters. One is with a smaller Diameter and other with a bigger Diameter. Using this system a person can apply a small amount of force for longer depth on smaller Dimater piston end, which can than move a much heavier weight resting on bigger Diameter tube’s piston for a proportionately smaller amount of distance.

This is the exact principle of how a hydraulic ram or jack works but in horizontal direction i.e. If you squirt fluid through a narrow tube at one end, you can make a plunger rise slowly, but with a lot of force, at the other end. Please refer Figure 1.

3 Basic Principle of TejHydroLift

TejHydroLift works almost same as Conventional Hydraulic Lift. The only difference is that it uses less water to move heavier load which makes it much more efficient. You can notice in Figure 2 below that above Figure 1 equilibrium of forces can also be represented as in figure 2 below. And you can yourself see that volume of water used in Figure 2 is less than in Figure 1.

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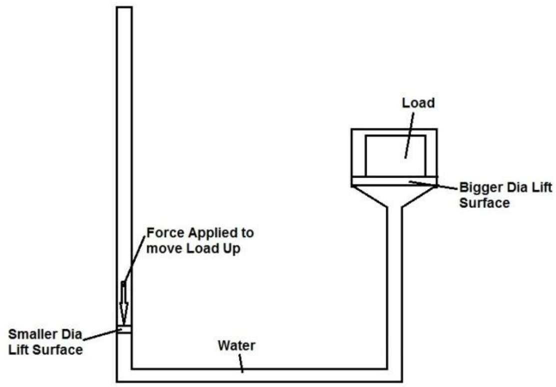

Fig. 1. TejHydroLift Hydraulic Lift

This is the main principle of TejHydroLift. If we have to move lesser water for moving same load than small force needs to be applied for lesser distance to move heavier load at other end. The complete description with full calculations is described in forward sections titled "Working of TejHydroLift System" and "Prototype Calculations".

4 Working of TejHydroLift

TejHydroLift System can be designed in many different ways. However the main principle remains the same as described in section 3 above. For illustration purpose we will show only a single configuration known as "Slim Antenna TejHydroLift Configuration". The Configuration is as described below:

4.1 About Slim Antenna TejHydroLift Configurati

The name of the configuration may sound a bit funny. But it is named so because we are using slim tube rather than another configuration called "TejLift" which uses fat hollow tube. And we included "Antenna" in name because lift will unfold with supports that looks much like how foldable antenna of old radios looked. Let us now look at how it is supposed to work.
Note: The Figures are just illustrative and not to size. The actual size of parts may vary.

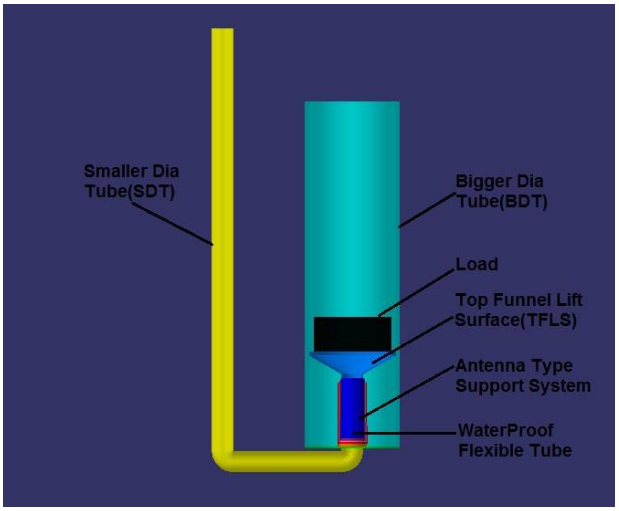

Fig. 3

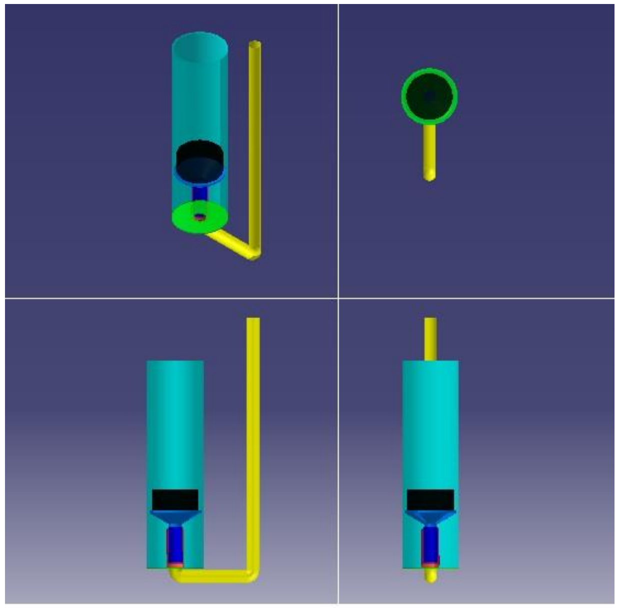
Fig. 4

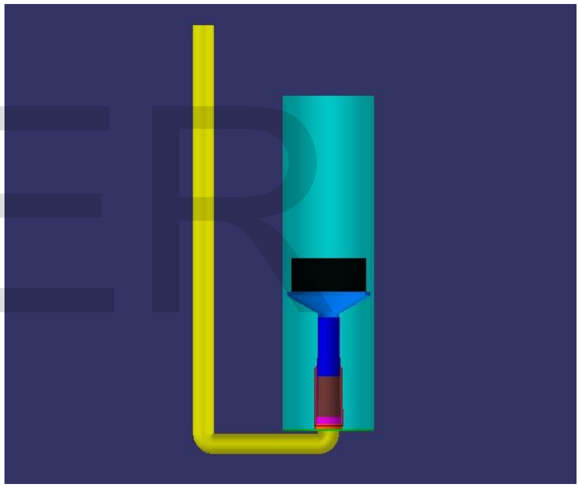
Fig. 5

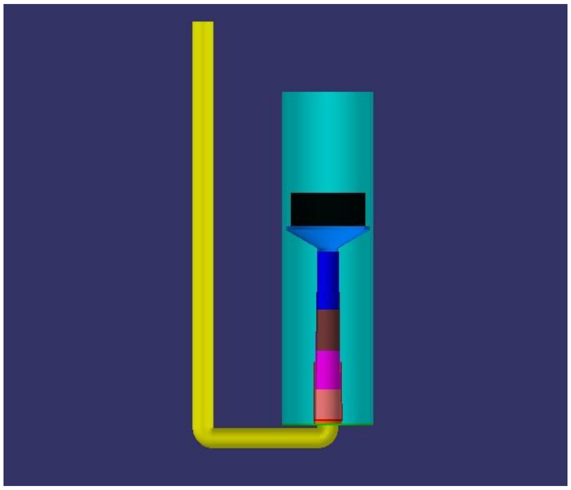
Fig. 6

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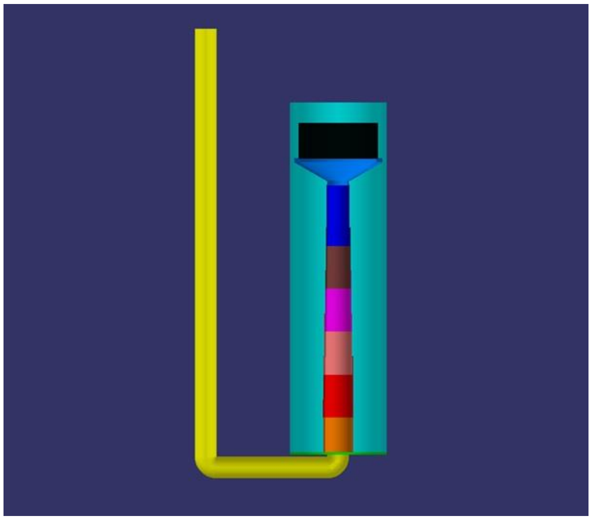

Fig. 7

4.2 Description about parts of TejHydroLift

Figure 3: As you can see Figure3 is Front view of TejHydro-Lift. Just as conventional style lift it has Big Dia Tube (BDT) and Small Dia Tube (SDT). But what happens at BDT is what makes it different. Inside BDT it has Top Funnel Lift Surface (TFLS). Below it is Antenna Support. This Antenna Support can extend or collapse just like the Antennas of old radios. Inside of Antenna Support houses a waterproof Flexible Tube (WPFT). The Antenna Support is there to support WPFT so that tube expands longitudinally and should not buckle under load laterally. Under high pressure it may be possible that we may not need antenna supports at all but we have to verify it to be true. For present paper we will use supports. Fluid from smaller Dia tube will be pushed to WPFT to move TFLS up to lift heavy loads shown in black color.

Figure 4 shows how TejHydroLift looks in Isometric, Top, Front and Side view, if we start looking from top left in cyclic manner.

4.3 Working of TejHydroLift in Details

Step 1: Figure 3. Here you can see the configuration where TFLS is at the lowest position. The Antenna support is in full collapse position. The load is lying on TFLS at its lowest position.

Step 2: We start applying Force at Smaller Dia Tube (SDT). This will force fluid into WPFT. So WPFT will start to Expand. And as WPFT can expand laterally only up to the size of its Dia, and its longitudinal expansion can only happen in the direction in which Antenna Support can expand. So as it starts expanding it starts expanding Antenna Support system as well. And so it starts pushing loads up slowly. Figure 5 Just illustrates one intermediate position where WPFT expansion helped move load through some distance up.

Here note that small pressure applied at SDT apply same pressure to move TFLS in BDT up. But force applied at BDT will be higher because of below Formula

$$\text{Force} = \text{Pressure} * \text{Area}$$

As Surface area of TFLS is higher the force will be higher to lift heavy load.

Step 3: As WPFT expands more and more. It expands Antenna Support more as well. This is shown as next intermediate position of Lift in Figure 6

Step 4: When WPFT has expanded to its full capacity. The TejHydroLift Sytem will look like as in Figure 7.

But the biggest thing to note here is that the distance up to which you need to apply force at SDT will be almost same or just little more or less than for at BDT, which all depends upon how you design your TejHydroLift System in better way. Which in actual means work to be done is very very less in TejHydroLift System then what was used to be in Convention Hydraulic Lift Systems. Because the formula for work is:

$$\text{Work} = \text{Force} * \text{Distance}$$

So if we suppose the load moves in BDT as must distance as Fluid was pushed in SDT. This same force and distance if would have been applied in Conventional Hydraulic Lift would have moved the Load by a very very small distance. Because the volume required to fill BDT would have been much more which in turn would have demanded force to be applied for a long distance.

This will make our TejHydroLift very very efficient.
But this raises more questions for Physics then Answer. It will put a question on Law of conservation of energy.
If we apply Law of conservation of Energy, the work done at both places must be equal which means:

$$W_{SDT} = W_{BDT}$$
$$F_{SDT} * D_{SDT} = F_{BDT} * D_{BDT}$$

According to our configuration we have already assumed that liquid is pushed through same distance downward in SDT, that moves the TFLS by same distance upwards i.e.

$$D_{SDT} = D_{BDT}.$$

Therefore

$$F_{SDT} = F_{BDT}$$
$$P_{SDT} * A_{SDT} = P_{BDT} * A_{BDT}$$

We know that pressure at both is same. Because pressure applied at fluid propagates in all direction. Therefore:

$$A_{SDT} = A_{BDT}$$

But we know that is not right because area is different. So this experiment is negating Law of conservation of Energy. And that is what makes this experiment very very interesting. From the Pascal Law it is evident that the system is going to work and push the load. But it then negates the “Law of conservation of Energy”.
So both Pascal Law and Law of conservation of Energy are in

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direct conflict with each other.
So we have planned to test this configuration out and determine which Law stands its ground.

4.4 Theoretical Prototype Calculations

Let's suppose radius of SDT R_{SDT} is 20mm = 0.02m.
Let's suppose radius of BDT R_{BDT} is 200mm = 0.2m.
Therefore Area of SDT is:
$A_{SDT} = pi * r^2$
$A_{SDT} = pi * 0.02 * 0.02$
$A_{SDT} = 0.0012568\ m^2$

And Area at BDT is:
$A_{BDT} = pi * r^2$
$A_{BDT} = pi * 0.2 * 0.2$
$A_{BDT} = 0.12568\ m^2$

Suppose we apply Force of 2 Newton at SDT. $F_{SDT} = 2N$
And suppose we move the Fluid at SDT down by 600mm i.e. $D_{SDT} = 600mm$
And suppose our BDT moved by similar distance D_{BDT} = 600mm.
According to Pascal law Pressure applied to any closed surface fluid propagates in every direction as shown in Figure 8 below.

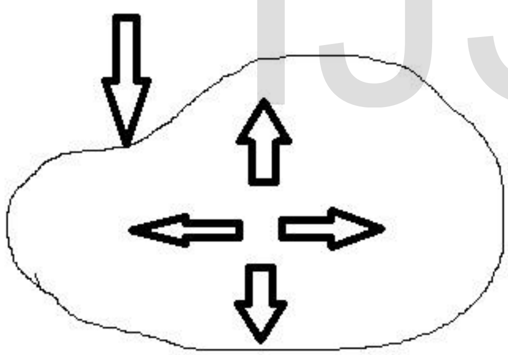

Fig. 8

Therefore pressure applied at SDT will be equal to pressure applied at BDT if we consider fluid to be incompressible. Therefore:

$$P_{SDT} = P_{BDT}$$

The Law of conservation of Energy state that Work done at SDT must be equal to Work Done at BDT. This used to be the principle on which Conventional Hydraulic Lifts worked. Means:

$$W_{SDT} = W_{BDT}$$

We know that Work = Force * Distance
So:

$$F_{SDT} * D_{SDT} = F_{BDT} * D_{BDT}$$
$$F_{SDT} * 600 = F_{BDT} * 600$$
$$F_{SDT} = F_{BDT}$$

As Force = Pressure * Area
So:

$$P_{SDT} * A_{SDT} = P_{BD}T * A_{BDT}$$

From Pascal Law we know $P_{SDT} = P_{BDT}$ [3][4][5]
So:

$$A_{SDT} = A_{BDT}$$

We know $A_{SDT} = 0.0012568\ m^2$ and $A_{BDT} = 0.12568\ m^2$. They were never equal.
So again we are vindicated that Pascal Law and Law of conservation of Energy is in direct conflict.
A similar conflict of Law of conservation of energy is cited in [7] by Author for energy generation.

5 Conclusion

This paper has provided a theoretically solution invention of new kind of Hydraulic Lift System which is supposed to revolutionize Hydraulic Industry. This solution looks feasible on theory and practical both. However it puts Pascal Law and Law of conservation of Energy in direct conflict which must be investigated.

References

[1] The explainThatStuff website. [Online]. Available: http://www.explainthatstuff.com/hydraulics.html
[2] The HydraulicMania website. [Online]. Available: http://www.hydraulicmania.com/hydraulic_lift.htm
[3] The NASA website. [Online]. Available: http://www.grc.nasa.gov/WWW/k-12/WindTunnel/Activities/Pascals_principle.html
[4] The hyperPhysics website. [Online]. Available: http://hyperphysics.phy-astr.gsu.edu/hbase/pasc.html
[5] The britannica website. [Online]. Available: http://www.britannica.com/EBchecked/topic/445445/Pascals-principle(2015)
[6] Tejinder Singh, "TejWell Dam," in *Conf. Rec. 2011 EuroPES Int. Conf.* ,Crete, Greece track. 714-021.