Willard Says……

Plain Suction Dredges

still plague the world of hydraulic dredge mining. My first thought at seeing one of these misfires is pity. Pity the owner. Pity the operator. More's the pity, a producer recently specified and took delivery of a new, million plus dollar, ladderpump, plain-suction dredge. That is like specifying a new Lear jet with reciprocating engines and propellers.

Plain-suction dredges violate most Dredging Commandments.

The success of plain-suction dredges can better illustrated in sports terms; no defense (helpless against oversize): no offense (cannot attack the deposit): doesn't play much (low production). These machines are listed as "Eunuch class" dredges for good reason.

Continuous, high production never happens.

Friction Winches

A note here about friction hoist winches such are commonly found on plain-suction dredges. *Willard Says……***Winches** gives friction winches the same bad rating that this paper is in process of giving plain-suction dredges.

Plain-suction dredges with elevated pumps are fairly common; they seem to go together. These features are both excellent choices for owners who are hell-bent on having a dredge with built-in, crippled production capacity. Locating the pump four or five feet above water guarantees that valuable effective vacuum will be wasted. Elevating the pump also makes it more difficult to prime; another good way to waste production time.

A friction winch, usually homemade because no winch manufacturer will put their name on such a liability magnet, is the perfect accompaniment to a plain-suction dredge with its pump mounted atop the hull. The one redeeming feature of a friction winch is a provision for free-fall. The operator can release the drum and allow cable to reel off freely until the brake is applied. This free-fall feature plays an important role when it comes to priming the dredge pump and drop-hammer dredging.

Elevated-pump priming is accomplished by raising the suction inlet above top of the pump shell, pumping the dredge system full of water and then rapidly dropping the suction. The pump is started the instant the suction hits the water.

If the operator's timing is good, pumping will commence immediately. He must remember to apply the hoist brake before the suction inlet stabs itself into the bottom of the pit. If his timing is off, the procedure has to be repeated until he gets it right.

Hydraulic planetary and wormgear winches lack the free-fall capability of the friction winch and therefore are not suitable for this priming procedure.

Plain-Suction Stingers

"Stinger" refers to the inlet end of a plain-suction suction pipe. Most plain-suctions have an elbow seven or eight feet from the suction inlet. The elbow—typically 45 degrees—causes the end section, the stinger, to angle downward.

Stingers fascinate me. They testify to the tremendous amount of thought that has been directed toward attempting to solve the insoluble: how to make a plain-suction dredge produce at a reasonably satisfactory rate.

Most stingers sport a conglomeration of bars arranged to screen out oversize. The simplest design is a bar spanning across the middle of the suction inlet. Others have an ornate bird-cage-like series of bars to provide numerous openings through which solids can pass into the dredge system. If oversize is present in the deposit, the suction inlet will eventually plug. The frequency of plugging is somewhat proportional to the amount of oversized particles. All plain-suction dredges by definition lack a mechanical means to clear plugged suction. Clearing the suction requires that pumping stop so that, hopefully, the ensuing back wash will flush away the plug.

Short Quiz

Q. Where does the oversize go when it falls out of the suction inlet?
A. Into the hole where the suction inlet was and will be when dredging resumes.
Q. Is it likely that the same chunks will be picked up again?
A. Very.
Q. When does this merry-go-round of plug-backwash-plug-backwash stop?
A. Never.
Q. Does backwashing have an adverse affect on production?
A. Yes. Production cannot get much worse than adverse.

If you believe in heaven and hell, plain-suction dredging is the dredging version of hell.

Sometimes a spear-like attachment is fitted to the end of the stinger. This is used to stab through the layers of "hardpan" in a procedure known as "drop-hammer" dredging.

Drop Hammer Dredging

When layers of mud, clay or cemented material are encountered, the plain suction lacks a means of penetrating or agitating or creating pumpable solids. Adherents of this archaic dredging method, almost without exception, call any layer of material that cannot be enticed to flow into the suction inlet, "hardpan."

Plain-suction dredgers deal with hardpan by raising the suction and letting it drop dozens of times. One should note that production is severely diminished anytime this procedure is carried out. Prolonged drop-hammering is justified in the opinion of many operators because there is a mother lode of quality aggregate located just beneath the hardpan. If only they could get down to it.

Despite my bad-mouthing, the chief virtue of the friction winch is manifest on the plain-suction dredge. A free-falling suction pipe is key to effective drop-hammer dredging.

The fact remains that any hopes of achieving efficiency or decent production with a plain-suction dredge are firmly rooted in the dream category.

The Rockbox

Really sophisticated plain-suction dredges, plagued with stoppages caused by oversized rocks, have rockboxes in the suction pipe. This is a large tubular box perhaps three feet in diameter and eight feet long inserted into the suction pipe at some point down the pipe far enough so that it is always submerged when pumping. A screen or grid of bars guards the outlet end of the box to prevent oversize from going on up to the pump. The box has a hinged access lid. It works like this.

The oversize rocks rise up the suction pipe and enter the rockbox where they are stopped by the screen, trapped and held. The rockbox is large enough to store a considerable amount of big rock so the need to shutdown/backwash happens less frequently. Less frequently, not eliminated because there are always rocks too big to enter the suction pipe. Only backwashing removes those. Some of the rocks that were residing in the rockbox may join the rush to the exit and escape in the backflow.

There comes a time when the rock box is full and must be emptied. Shut the pump down, open the access lid and remove the rocks one at a time by hand. Really, really modern rockboxes have a hydraulically operated lid in the bottom of the rockbox to mechanize the dumping procedure. Then there is the question of what to do with the rocks. It would seem like an exercise in futility to dump them back in the water where they may find their way back into the rockbox but that is where some operators put them. After the box is emptied and closed, the pump has to be primed so they can get back to the business of pumping. For a while. Pretty slick huh?

Plain Suction Shines?

Reportedly, plain-suction dredges really shine when mining sandy, free-caving deposits. I have installed rotary cutters on plain-suction dredges operating in veritable sugar bowls and production has *always* soared. Why? Because the digger attacked the deposit, loose as it may be, and assured that an ample supply of pumpable solids was continuously available at the suction inlet. Another benefit of having a digger fitted to the suction inlet is that of “shielding.”

Sand and gravel mining is carried out by undercutting the base of the bank of solids to provoke cave-ins. Small cave-ins are desirable; however, they often require the plain-suction operator to raise the suction inlet to prevent choke-off and cavitation. Plain-suction dredging is accomplished by digging holes. Cave-in material naturally flows down to fill the funnel that is the hole created by the suction inlet. Quite often, the suction inlet is to be found, choked off, at the bottom of that hole.

In contrast, a rotary cutter should cut in a sideways sweeping motion without digging holes. Sweeping creates a “floor” where cave-in solids can spread out so the depth of cave-in material over the suction inlet will be reduced. The rotary cutter “shields” the inlet by providing numerous channels where water can continue to enter the dredge system despite being partially covered. The likelihood of severe choke-off is diminished.

> Plain-suction dredging is about as successful as you would be at making love to your wife in a hammock---standing up.

Water Jets

The idea of using water jets to create pumpable solids is very popular in some areas of the country. Popular does not mean effective. Popular does not mean productive. It just means that a lot of people are pumping a lot of water for meager return. One explanation for the regional popularity of this spectacularly inefficient method of creating pumpable solids is, “monkey see, monkey do” or perhaps, “All the other kids are doing it”.

Case History #1

Some time ago I visited two plain-suction dredges; one ladderpump: one hullpump. Aside from the location of the pumps, both machines were similarly equipped. Each dredge pump was driven by a 600-hp electric motor, each dredge had two, 400 hp, jet water pumps (that’s right, a total of 800-hp worth of jets on each dredge) and each had an array of nozzles arranged around the suction inlets. Both dredges were, and had been for some time, suffering from low production according to the manager.

Some time after my visit I came across a magazine article featuring these two dredges. Despite all the verbiage and nice pictures, there were no claims made about productive capability, which, to me seems to be the most important feature of any dredge. The article was dated 14 years before I laid my eyes on them. These folks had been blasting all that water for all that time and were still looking for the cause of such poor production!

This in an area where the rule of thumb is that electricity costs $35,000 to run a 100 hp electric motor for one year 24/7. That means that the energy to power the jets on one dredge costs $32.00 per hour for 800 hp or $64,000 for a 2,000 hour work year. And they still have production problems.

Case History #2

We recently commissioned a new, similar-sized, ladderpump dredge in a pit not far from the "squirters" described in Case History #1. It has a semi-automated linear cutter that requires about 35 horsepower to operate. It has **no water jets**. There have been no complaints about production because the *average* rate of production is 550 tph—all the plant will accept. The production goal of 650 tph will be achieved as soon as plant modifications are complete. Note that the production rate is average—not peak, not intermittent—average.

This dredge produces continuously at a controlled rate because the linear cutter assures that an ample supply of pumpable solids is continuously available at the suction inlet. It goes through layers of clay and "hardpan" with no discernible difficulty. These same layers frustrated the productive efforts of a rotary cutter dredge that was in use prior to delivery of the new, linear cutter dredge.

Thirty-five horsepower will cost about $2,800 for electricity to operate the linear cutter for 2,000 hours of operation. Granted, the linear cutter will have higher maintenance costs than the water jets—about two cents per ton in this application—$20,000 for 2000 hours at 500 tph. Assuming that maintenance for the jet system is zero, which you know ain't so, the net savings is $41,000 using an aggressive linear cutter instead of the toothless jets.

Our dredge, equipped with a digging device—a linear cutter—is mining continuously at a high rate of production. Year after year the "squirter" dredges have relied on inefficient, expensive, ineffective water jets to obtain lousy production.

We recently heard the comment that the linear cutter on our dredge was a "misapplication." There are **no other** similar-sized dredges mining in this area—new, used or homemade—that are producing anywhere near what our dredge with the "wrong" digger is doing or at lower cost per ton. That includes the old "squirters", the new million-dollar plus "squirter" and rotary cutter-equipped dredges delivered by our competitors.

It seems clear that anyone who really wants to conduct efficient, productive dredge mining operations should find out more about our "misapplied" digging devices.

Conclusion

Dear reader, I have harangued you for five pages about the futility of trying to produce on the cheap with a plain-suction dredge. I have said all I have to say on the subject. Let me reward your persistence by suggesting how to vastly improve the productive capability of your plain-suction dredge at modest cost.

We developed the MUZZLELOADER series of hydraulic-driven rotary cutters specifically for installation on plain-suction dredges. These cutters **do not** require a ladder; no need to have a hinged structural framework between the hull and the rotary cutter. Install the MUZZLELOADER assembly in place of the stinger. The weight increase is not all that great so there is a good chance that you can continue to use your friction winch to prime the pump. The friction winch will not be needed for drop-hammer dredging because the MUZZLELOADER will make that frustrating procedure just a memory.

The MUZZLELOADER has resurrected the productive potential of numerous plain-suction dredges ranging in size from 6 to 16 inches. A MUZZLELOADER will stuff solids into your suction inlet at a rate that will make you very happy. And prosperous. Contact us for more information.

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