5 inch Dredge Model 5109H

Product Report

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KEENE ENGINEERING'S 5" EDUCTION DREDGE EQUIPPED WITH NEW OVER/UNDER DOUBLE SLUICE BOX.. MODEL 5109H.

This report is based upon data developed on tests conducted in the East Fork of the San Gabriel River, San Gabriel Mountain Range, State of California. The site of the test was approximately one-half mile south of the confluence point of the East Fork of the San Gabriel River with Cattle Creek in the Angeles National Forest. The test area was of typical placer geology for the area.

EQUIPMENT:

The equipment used to conduct the test was a new Keene Engineering 5" Eduction Dredge equipped with the prototype version of the over/under double sluice box, as fed by a standard production model 5" Marlex Jet Flare fitted with a 5" jet powered by a 3" singlelog inlet with 20 feet of 5" Tigerflex suction hose. The engine and pump assembly consisted of a factory-new Honda GX270 9H.P. overhead valve engine fitted to a Keene Engineering P350 pump with a 4" intake and 3" discharge outlet. The engine was also equipped with a directmounted belt driven Thomas model T80 low pressure compressor fitted to a Keene Engineering RT1 reserve tank and 20 feet of air line.

The factory supplied Honda muffler and spark arrestor assembly was removed and replaced with a single diver Stapp Mining Company water heater equipped with a stock Briggs & Stratton muffler and spark arrestor assembly. The water heater was supplied with feed water directly from the P350 pump via the integrally fitted factory hose connection. All clamps, hose connectors and the jet were pre equipped with quick disconnect style couplings.

It should be noted that the following test was conducted after the equipment was subjected to a 20 hour break in period where initial engine operation, gaskets, seals and hose and tube connections were checked for leakage and proper connections. An initial factory specified oil change was performed on the engine after the break in trial period, but before the commencement of the test period.

ASSEMBLY AND SETUP PREPARATION:

After the initial break in period, the equipment was disassembled into transportable component parts and checked for defects while basic factory recommended engine maintenance was performed. No defects were noted in the factory manufacthe ture or assembly of the component parts.

On the first day of the test period, all equipment was checked for operational readiness and transported to the site of the test. The entire dredge was assembled by two persons without the use of tools in approximately 15 minutes and floated into a preselected position in moderate water flow. Fuel and oil levels were confirmed and initial operation was commenced.

Adjustment of the sluice box angle, jet flare and jet depth was determined based upon the depth of dredging operation and type of material being educted and sluiced. At times during the test it was necessary to drop the jet position using the provided holes in the jet hanger support strap to increase the eductive power based upon the depth of the material being transported up to the surface. Other times it was necessary to adjust the angle of the Marlex flare where it met the head end of the sluice box so that a better flow of water was more evenly distributed over the leading portion of the sluice box in order to prevent the first section of riffles (as covered by the first grizzly) from being clogged with loose material that was not compacted in the stream bed, and which thus had a tendency to be educted faster that harder packed materials.

Lastly, it was also necessary to adjust the angle of the sluice box on the dredge frame several times in order to achieve a satisfactory average angle. This was noted to be necessary due to the change in weight of the sluice box as the heavier materials began collecting in the lower/under sub sluice. Once a median position was determined, the sluice box was left in this position and operated without incident for the remainder of the test period.

NOTED DIFFICULTIES:

The only problem of concern was found approximately seven days into the test when the T80 compressor pulley rotation was periodically stopping and starting while the engine was running at constant speed. It was determined that the pulley would begin slipping when the demand on the air supply was low, or the engine R.P.M. was slow enough to decrease the friction on the drive belt. Operations were immediately stopped and the problem was determined to be caused by the compressor not being held in a secure manner on the mounting plate. A further examination revealed that the flat washers on the compressor mounting bolts did not have enough purchase against the underside of the aluminum compressor bracket to hold the compressor in position without it “walking" up the adjustment holes in the mounting plate. This problem was corrected that day by removing the compressor mounting bolts and installing stellated style lock washers underneath the supplied flat washers, and re tightening the bolts after a correct belt tension was obtained and the compressor blocked into position through field expedient means while the dredge was still afloat. No further problems of this nature were found to occur throughout the test.

SLUICE BOX OPERATIONAL PERFORMANCE:

After approximately two days of running time, it was determined that the secondary grizzly needed to be removed frequently in order for the riffles to adequately clear out. The height of the grizzly was varied in an attempt to remediate this problem, but it was found that a satisfactory level could not be achieved without constantly changing the jet flare angle or angle of the sluice box on the dredge frame. It was eventually decided to remove this secondary grizzly. The continued operation of sluice box went unhampered with this removal as there was more than enough water flow through the box to remove the heavier cobblets out and over the riffles after they dropped off of the first grizzly.

It was also found that the sluice box operated at peak performance (in terms of keeping itself clean) when the water flow was kept about 1/2" below the top edge of the box at the discharge end. This only required that the engine be operated at approximately 60% throttle for most situations, even when the depth of the dredging reached 12 feet below the water surface.

Some packing of material was found to occur under the first grizzly when the dredged material was in a state of heavy saltation and suspension, and thus was more readily educted in higher quantities much faster. A field expedient fix was effected which raised the rear of the grizzly approximately one half inch above the tops of the last set of “V" bars attached to the riffles below the tail end of the grizzly. This did not impede the rearward movement of cobblets off the grizzly and out of the sluice box, and also did not require the further adjustment of the jet flare or sluice box on the dredge frame.

SUBSLUICE OPERATION:

Initially, the sub sluice was cleanedout on a daily basis to see how it was operating and what type of material was being collected and held throughout its length. It was later determined that a daily clean out was unnecessary, and actually took more time than necessary on a daily basis to conclude the day's operations. Once it was determined that there was not going to a problem with the sub sluice “loading up" it was left in place for up to three days at a time, depending upon the type of material encountered during dredging operations. (The added weight of the sub sluice material helped keep the dredge platform stable and obviated the need to constantly change the sluice box angle on the frame to compensate for the lighter box weight when it was empty. Once the sub sluice was emptied and the discharge end of the dredge was felt to be too high, a spare diving weight belt was set on the discharge end pontoons until the sub sluice had accumulated enough weight to achieve a satisfactory angle of operation). Although not emptied and cleaned on a daily basis, the sub sluice was examined on a

daily basis for distribution of values and to make sure it was not clogged. This was easy to do based on the design of the large removable top plate which allowed the riffle tray to remain undisturbed.

It should be noted that such an inspection should only be done when the box has been allowed to drain of water and the material allowed to settle, so that the removal of the top cover does not allow the sub sluice riffle tray to become raised and the material allowed to flow underneath the riffle bases, which then make reassembly impossible without a total clean out being performed.

The sub sluice was found to trap and hold a great deal of fine material, and was responsible for the recovery of the bulk of the minus 20 screen values recovered during the test period. It did not pack up when a lot of fine material was being dredged, as the punch plate entry to the sub sluice would only admit a metered amount of material, with the excess being allowed to travel forward an into the top sluice where it was sluiced, and discharged normally, with the values being held in the first few sections of the upper box riffles.

One anomaly was found in the sub sluice: an inordinate amount of rocks that were approximately the size of a dime, and very flat in thickness. It is postulated that these rocks entered into the sub sluice either through the sides of the punch plate, or under the back lip of the punch plate when material would build up in front of the punch plate lip at the discharge end of the Marlex flare. This would have the effect of raising the rear of the punch plate slightly, allowing a vacuum like effect to suck these rocks into the lower sluice. Their presence was not detrimental to the sub sluice operation, and the majority would most often wash out the discharge end of the box in time. Only the flattest and biggest such stones would remain in the riffles.

Their out flow from the box during operations could be detected by placing one's hand under the discharge end of the sub sluice and feeling them drop out along with the lighter sands and materials. This was quite evident even when the discharge end of the sub sluice was under water as the pressure of the water at the head end of the sluice was sufficient to push the water down into and through the sub sluice on account of its own weight and the additional pressure created by the dampening flap trailing over the jet flare discharge flow.

OBSTRUCTIONS:

Operational obstructions were infrequent and mainly consisted of flat “skipping style" stones that would orient themselves in such a was as they traveled up the suction hose to become lodged in the log opening in the jet. These stones would then cause a fairly large jam which usually could be freed with a rod after decreasing engine speed to an idle. Very infrequently was it necessary to remove the suction hose from the jet quick release and manipulate the jam from both sides in order to clear it.

Hose jams were virtually non existent and were always able to be cleared by manipulating the hose in the water. The flexibility and ductile nature of the hose made jam clearing easy and undoubtedly prevented a majority of jams in the hose itself. No jams were noted to have occurred in the Marlex jet flare and only a few jams occurred in the swivel nozzle. These were almost exclusively triangular shaped rocks with a slow taper which lent themselves to sticking firmly in the nozzle. Breaking suction by raising the nozzle out of the water momentarily would usually free this type of rock without the need for further tools or shutting down the dredge.

FUEL CONSUMPTION:

The total running time for the test period consisted of 100 hours over 20 working days. Intermittent days off were taken for rest and maintenance purposes, as well as supply trips and the like. A total of 42 gallons of 87 octane gasoline was consumed by the 9 H.P. engine during these 100 hours. Fuel consumption was therefore .42 gallons per hour of running time. The average price per gallon for fuel during the test period was $1.35 per gallon. Accordingly, the fuel cost per hour of running time equates to 56.7 cents per hour.

One oil change was performed during the test period for the purposes of determining the engine break in process and to ensure that no metallic fragments were left in the engine as a result of the assembly process at the factory. This added $2.40 to the operational costs and when factored into the fuel cost perhour, raised the operational costs to 59.1 cents per hour.

VOLUME OF MATERIAL MOVED:

An estimate of the hole dredged during the test period indicated that it was an average of 10 feet wide at all times, and extended for a distance of approximately 65 feet. The depth ranged from 8 feet at the shallow end, to a depth of 12 feet at the forward end. The 8 foot depth continued for a distance of 20 feet, and then dropped to a depth of 10 feet for an additional distance of 25 feet. At this point the depth dropped to 12 feet for the final 20 feet to the forward end of the hole.

A conversion of the above figures into cubic yards indicates that a total approximate amount of 241 cubic yards of material was moved. (It should be noted that not all of this material processed through the dredge. A significant amount was of a size larger than the nozzle intake, and therefore was moved by hand, or winched out of the hole). It shouldl alsobe noted that much of the material being dredged was also heavily impacted with clay. This 'hard packed" conditon as well as the larger cobbles unable ot pass through the suction intake, can significantly effect the "yard per hour rating" indicated by the manufacturer.

Dividing the amount of material moved by hours run, provides a figure of 2.41 cubic yards of material being moved per hour. If one further assumes that only 4 hours of actual dredging time occurred over the 20 work days (leaving 1 hour per day of running time for water heater warm up and clean out time) this would revise the material moved figure to 3.01 cubic yards moved per hour (241 cu. yd. divided by 80 hours of actual dredging time), or 12.05 cubic yards of material flow through the dredge in a 4 hour period.

COST TO MOVE MATERIAL

As previously indicated, it cost 59.1 cents per hour to operate the dredge during the test period. If we then assume the previous figure of 3.01 cu. Ds. being moved per hour, it can be calculated that it cost 19.63 cents per cubic yard of material moved, at the average price of gasoline listed above.

REQUIRED VALUES PRESENT IN MATERIAL MOVED:

Given the forgoing figures, it can then be calculated how much values must be present in the materials being moved for the operational costs of the dredge to make a break-even point.

The average price per cwt. gold during the time of the test was $19.50 per dwt at a fineness of .999, and $17.55 per cwt. at a fineness of only .900. Dividing the cost per cubic yard of material movement, the material must contain at least .0100 cwt. of value per cubic yard at .999 fineness, and at least .0111 cwt. per cubic yard at a fineness level of .900. (This is determined by dividing the cost of movement of each cubic yard by the price of value per cwt.)

However, it must be understood that even though the material may contain the above required levels of values (at the listed prices and during the times when gasoline is at the test period levels per gallon), this may not be the level of efficient recovery one experiences with the equipment tested. Accordingly, if no assay of the value. content of the materials moved is performed, and one does not exceed the break even recovery level of values, it cannot conclusively be known at what recovery efficiency level the equipment is functioning.

CONCLUSION:

Depending upon the price of values recovered and the operational costs encountered, the equipment presented itself as a very reliable, easily transportable and economical means to conduct values extraction. Most of the test time was conducted by one person running and maintaining the equipment once it was brought to the test site, thereby indicating that the addition of more personnel to an operating crew would certainly increase the amount of material capable of being moved, and thereby theoretically increase the amount of values recovered.

ADDENDUM TABLE OF VALUES RECOVERED DURING TEST PERIOD:

A total of 20.2 dwt of values were recovered from the material moved during the test period. (A periodic check of the tailings was made with several recovery methods, and it was determined that no identifiable loss of values was occurring during the times the tailings were being monitored on a daily basis).

1.8 cwt. in + 4 screen size nuggets
7.7 cwt. in 20 screen size flake and pieces
4.0 cwt. in 16 screen size flake and pieces
3.3 cwt. in 12 screen size small nuggets
1.7 cwt. in 8 screen size small nuggets
0.9 cwt. in 4 screen size nuggets
0.8 cwt. in dust

It should be noted that the 0.8 cwt. recovered and listed as "dust" is indeed just that. This material was caught and washed out of the upper and lower sluice carpeting after the final clean out on the last day of the test period. It appears so fine that it stays in suspension in water when agitated. This would tend to substantiate the above referenced minimal loss of values experienced in the testing of the tailings, and also indicates that the surface tension of the water exiting the jet flare is adequately being broken, so that this material is given the opportunity to settleout and be entrapped in both sulice boxes.