

An Engineering Feasibility Study
The Compaction Of Arsenious Dust

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- 1.0 Summary
- 2.0 Scope of Study
- 3.0 Alternative Compaction Methods
- 4.0 Conclusions

Appendicies

- A. Layout Sketches and Data
 - 1. Flowsheet Flat Roll Compactor
 - 2. Flat-Roll Compactor
 - 3. Hydraulic Plunger Compactor.
- B. Cost Estimates
 - 1. Capital Cost-Flat Roll Compactor
 - 2. Capital Cost-Hydraulic Cylinder Compactor
 - 3. Annual Operating Costs and Savings
- C. Equipment Data
 - 1. Roll Compactor
 - 2. Pneumatic Plunger Compactor
 - 3. Extruders

" ARE BELIVED "
WHAT THIS MEANS ?

An Engineering Feasibility Study
The Compaction of Arsenious Dust

1.0 SUMMARY

As a sequel to the pilot testing completed at the Thornhill Laboratory, a flowsheet, an equipment layout sketch and preliminary estimate was prepared for the use of a flat-roll compactor. Previous experience at other locations has proven that the roll compactor is a dusty, high maintenance piece of equipment. Subsequently, alternate methods were examined to agglomerate the material, these included the use of:

- ALT II. 1. High frequency Concrete Vibrators. (NOT PRACTICAL)
- ALT III. 2. Hydraulic Plunger Compactors.
- ALT IV. 3. Extruding Machines. (NOT PRACTICAL)

The use of a flat-roll compactor and hydraulic plunger compactor are believed to be practical to compact the dust. Both machines would require costly maintenance and would result in dusty operations. De-dusting equipment has been provided in both schemes to keep this problem to a minimum. The use of high frequency concrete vibrators or extruding machines to compact the dust is impractical. The preliminary estimated cost to install a system to handle two tons per hour is \$190,000 and \$200,000, for a flat-roll compactor and pneumatic cylinder compactor respectively. Annual savings resulting from the compaction of the dust are estimated to be \$100,000 annually, this would give a pay-back period of less than 2 years. (see Appendix B-3)

2.0 SCOPE OF STUDY

Basic data used for the study was outlined in two reports from the Thornhill laboratory dated July 9, 1975 and September 10, 1975. The characteristics of the arsenic dust tested are outlined as follows:

- a) Bulk Density (as received) = 26.2 lb/cu.ft. ← 76 CF/TON ?
- b) Moisture Content (as received) less than 0.1%
- c) Material shown to be arsenolite (As_4O_6), grains have cubic structure.
- d) Absolute Density of arsenolite = 242.9 #/cu.ft.
- e) From visual examination, it is estimated that 100% of the material would pass a #200 sieve, no grain size data available.
- f) Tests were conducted at 3% and 5% moisture contents, at both moisture contents, dusting was reduced considerably with the addition of moisture. At 5% moisture the material stuck to the rolls and at 3% moisture the material bridged at the bottom of the feeder cone. It can be assumed that a maximum of 3% moisture is required and forced feeding is required to the rolls. Balling of the material was noted

2.0 SCOPE OF STUDY (cont'd)

when moisture was added during drum blending.

- g) Compaction - Pilot tests indicate that only marginal compaction is achieved in the roll press beyond a 2000 psig forming pressure.

A compaction test was completed on a laboratory sample in a container. The material in the container was dry and the container was rolled to give the maximum volume of material. The container was then vibrated, a 40% decrease in volume resulted. If the initial density was approximately 26 lbs./cu.ft. as indicated by Thornhill tests, the density after vibrating the container would be in the order of 40 plus lbs./cu.ft.

The lab tests were used as the basis for the flow sheet developed in Appendix A-1. This flowsheet incorporates a splitter after the roll compactor and half of the material is recycled to achieve a higher density. The flowsheet for the hydraulic plunger compactor has identical parameters except there is not an allowance for recirculation, as it is not required. Feed to the cylinder was direct through a screw conveyor/blender and the compacted product was discharged directly into the storage bin. The basic design conditions for the above schemes are.

1. Average Tonnage 15 T.P.D.
2. Instant Rate (several hours) 30 T.P.D.
3. Surge Bin Capacity 400 cu.ft. (5 ton @ 25 lbs./cu.ft.)
4. Ribbon Conveyor/Blender has 1 hour blending time
5. Steam Generator 0.5 lbs./min. to 1.5 lbs./min.
6. Briquett Press: 20.5 inch dia. x 9 inch wide rolls variable speed drive and force feeder
7. Hydraulic Cylinder Compactor. 8 inch dia. x 20" stroke.

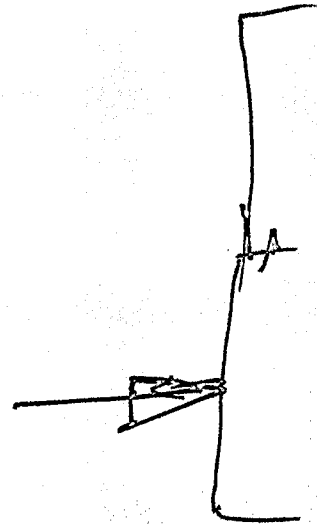
Two alternative schemes were reviewed but were found to be impractical for this purpose. These were the use of high frequency concrete vibrators and extruders.

3.0 ALTERNATIVE COMPACTION METHODS

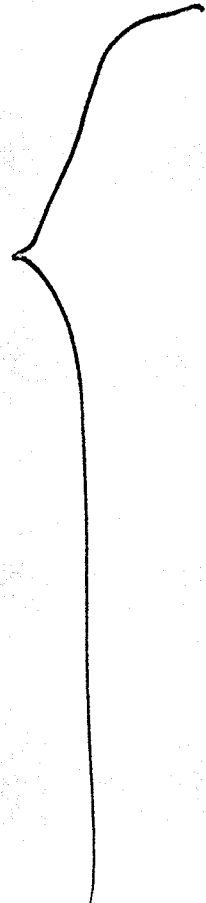
The pilot work carried out using the flat-roll compactor has proven this as a viable and practical method of compacting the material. Water can be used as a binder and it also serves to reduce the dust problem. Provision was also made to enclose the rolls and put the compaction area under negative pressure to reduce any dust hazard in the working area due to the toxicity of arsenic. To prevent any possibility of arsenic dust permeating into other underground areas a concrete bulkhead and dust tight door has been provided for in the estimate.

ACT I

WHY CONCRETE MIXER ARE
NOT PROTECTED



ACTUAL
TEST
NOT
CARRIED
OUT



3.0 ALTERNATIVE COMPACTION METHODS (cont'd)

This operation can best be installed underground as there is less danger of the dust escaping to the atmosphere. If it was located on surface a dust tight building would have to be provided and an alternative system would have to transport the compacted material to permanent underground storage. For the above reasons it is recommended to place the compaction facilities underground.

ALT I

The needle head, high frequency concrete compactors work extremely well in concrete because the material is a non-compressible slurry as compared to a compressible fluid such as arsenic dust and air. When the material has a density of 26.2 lbs/cu.ft., there is less than 11 percent solids by weight in a cubic foot of material.

ALT II

Normally, concrete pours are confined to limited areas and are made up of small batch mixes. After each batch is poured in place, that portion is vibrated and compacted. Vibrators are only effective in the immediate area in which they are placed. Thus it is necessary to place the vibrator by hand in several locations in each batch. This procedure would be impractical in a large bin which has a continuous flow into it. The toxicity of the material would rule out any manual operation. For the above reasons, the use of high frequency concrete vibrators is impractical in the arsenic dust.

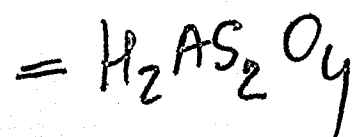
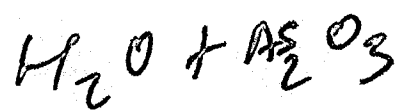
S.H. Design and Service Co. Ltd. were contacted to determine their approach to this problem. They have recommended a hydraulic plunger compactor for the application. (See Appendix C-2). The equipment is custom made and the final design is dependent on data developed in pilot tests. A pilot test is required to determine:

- a) Whether the use of a hydraulic cylinder is practical to compact this type of material.
- b) The behaviour of the material and whether additives, etc. are required for compaction.
- c) Size of equipment required to meet the production rate.

ALT.

III

Until pilot tests are completed, it cannot be determined whether or not this scheme would work. The cost of this scheme is estimated to be in the same range as that for the roll compactor. The obvious advantage of this scheme is that recirculation of the material is not required.



ARSENIC ACID

←
WATER
WITH ARSENIC
YIELDS
ARSENIC ACID.

3.0 ALTERNATIVE COMPACTION (cont'd)

Agglomeration of different materials can be accomplished with extruders. Extruding machines are used to form, de-aerate and/or increase the density of materials that are basically free flowing and have plastic characteristics. The arsenious dust is dry and each grain has a cubic shape. A lubricant (water) would have to be added for extruding to give material plastic characteristics. If too much water is required, seepage of water underground containing arsenious acid ($H_2 As_2 O_4$) could be a future problem. The material in a dry state will not extrude or agglomerate. It is felt that the use of an extruder for the above reasons is impractical.

4.0 CONCLUSIONS

There are two schemes that are practical to compact the arsenic dust, they are the flat-roll compactor and the hydraulic piston compactor. The development of the flat-roll compactor is recommended as pilot tests has proven that this equipment can be made to work.

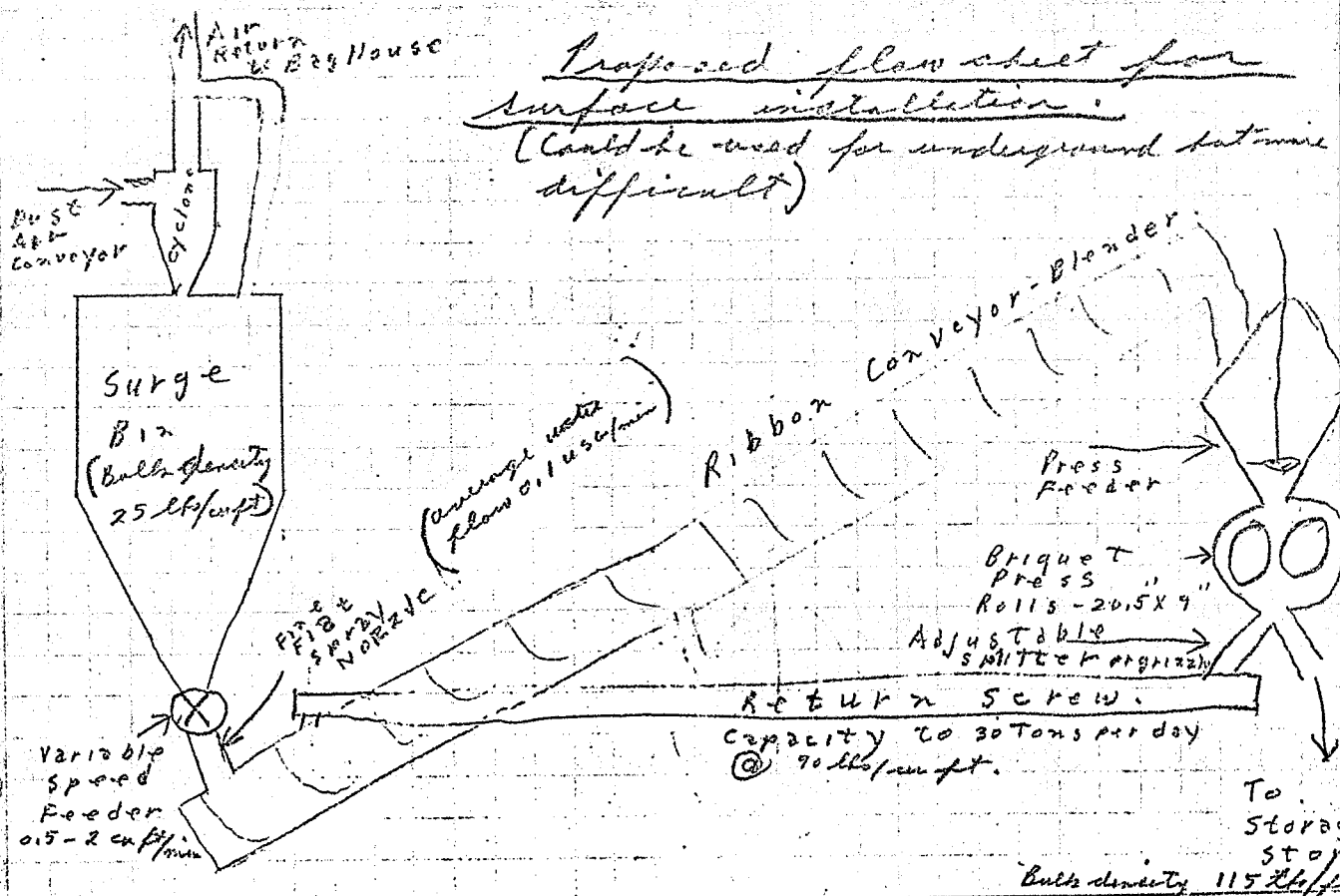
The cost of the installation for a flat-roll compactor at \$190,000. The annual savings before taxes are estimated at \$100,000. Dependent on the period of depreciation for this installation, the payout time is probably less than two years.

APPENDIX A

Layout Sketches and Data

1. Flowsheet Flat Roll Compactor
2. Flat-Roll Compactor
3. Hydraulic Plunger Compactor

BULK DENSITY
AS COMPACTED
115 lbs/EF.



Tonnage to handle - less than 20 T.P.D. average
instant rate to 30 T.P.D.

Bulk density of incoming dust - 25 lbs/cu ft

Surge bin capacity - 2 hrs say 150 cu ft

Ribbon Conveyor Blender
Roughly 1 hr blending time - 72 cu ft active
or 4' dia X 12' long

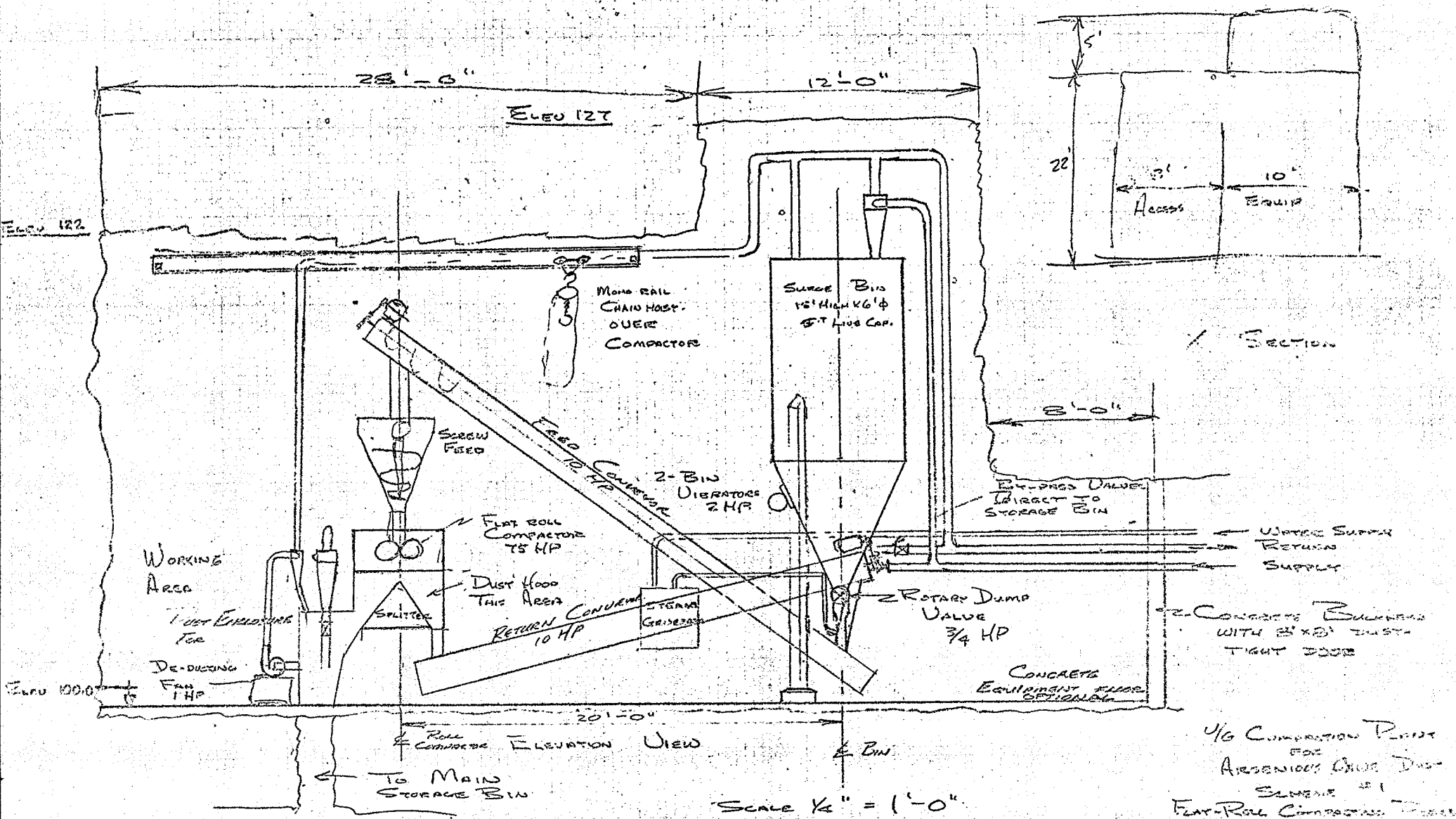
Spray nozzle - 0.145 g/min at 40 p.s.i.
(flat spray type) with good spray pattern
on pressure turn up
turn down

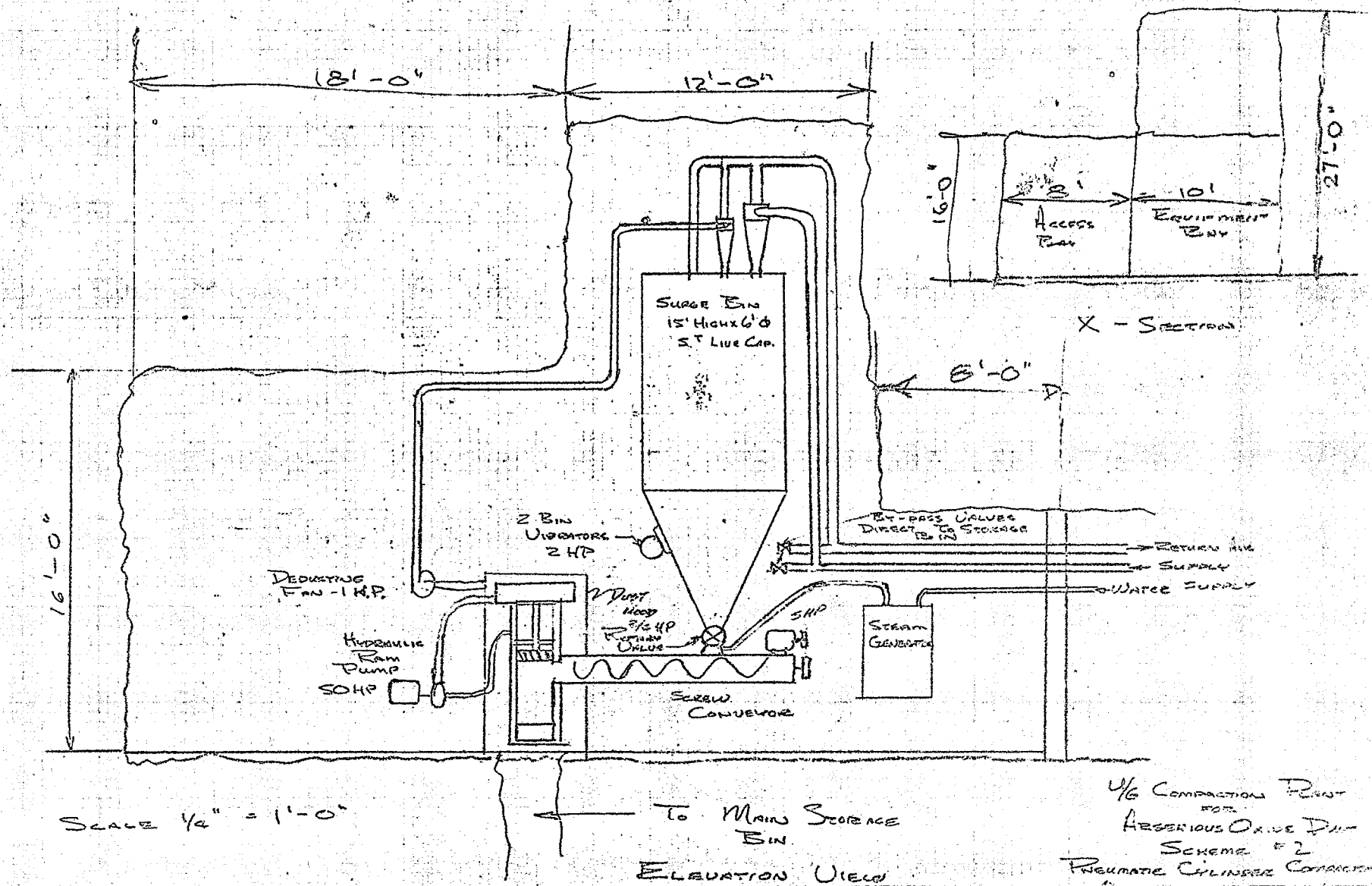
Briquet press - 20.5" dia rolls - 9" wide
Complete with force feeder
and variable speed drive
Roughly height of press & feeder
roughly 7 feet

EXCAVATION

5 x 10 x 12 → 600 CF.

22x





APPENDIX B

Cost Estimates

1. Capital Cost-Flat Roll Compactor
2. Capital Cost-Hydraulic Cylinder Compactor
3. Annual Operating Costs and Savings

CAPITAL COST ESTIMATE

FALCONBRIDGE NICKEL MINES LIMITED

ENGINEERING DEPARTMENT, TORONTO

PROJECT: COMPARISON OF AERANTOX
OXIDE DUST DESCRIPTION: SUMMARY PROJECT NUMBER: _____

LOCATION: GRAND CLOUENITE SECTION #1 AREA NUMBER: _____

PREPARED BY: J.D.M. DATE: June 22/76 REVISION & DATE: _____ SHEET 1 OF 5

ACCOUNT NUMBER	DESCRIPTION	QUANT.	UNIT	TOTAL WEIGHT	UNIT COST		ESTIMATED COST				TOTAL
					LABOUR	MATERIAL	LABOUR	MATERIAL	SUB. CONTR.	EQUIP.	
	CIVIL WORK			11,000 [#]		SEE	SHEET # 2				\$40,800
	MECHANICAL WORK			20,000 [#]		SEE	SHEET * 3 & * 4				\$13,270
	ELECTRICAL WORK			9 000 [#]		SEE	SHEET # 5				\$23 500
	FREIGHT.			40,000 [#]		USE 2	TRUCK LOADS @ \$1000 ^{ea} /LOAD				\$2000
	ENGINEERING 7%									SUB TOTAL	139,570
	CONSTRUCTION OFF & PERMIT - 15%										9,770
										SUB TOTAL	149 340
	CONTINGENCY 10 %										22 400
										SUB TOTAL	171 740
											17,175
										TOTAL	188 915
	✓						USE \$190,000.00				

CAPITAL COST ESTIMATE

FALCONBRIDGE NICKEL MINES LIMITED

ENGINEERING DEPARTMENT, TORONTO

PROJECT: COMPACTION OF ARSENIOUS OXIDE DUST DESCRIPTION: CIVIL WORK PROJECT NUMBER: _____

LOCATION: GIANT YELLOW KNIFE SCHEME #1 AREA NUMBER: _____
MINES

PREPARED BY: J.D.m. DATE: JAN 20/76 REVISION & DATE: _____ SHEET 2 OF 5

[illegible]

CAPITAL COST ESTIMATE

FALCONBRIDGE NICKEL MINES LIMITED

ENGINEERING DEPARTMENT, TORONTO

PROJECT: COMPACTION OF ARSENIOUS OXIDE DUSTDESCRIPTION: ARSENIOUS OXIDE DUST

PROJECT NUMBER: _____

LOCATION: GRANT THERMOPLASTICCOMPACTION (A)

AREA NUMBER: _____

PREPARED BY: L. H.

DATE: _____ REVISION & DATE: _____

SHEET 3 OF 5

ACCOUNT NUMBER	DESCRIPTION	QUANT.	UNIT	TOTAL WEIGHT	UNIT COST		ESTIMATED COST				TOTAL
					LABOUR	MATERIAL	LABOUR	MATERIAL	SUB. CONTR.	EQUIP.	
	15' H x 6' S CONICAL DRY BIN	1		4200	.50	.40	2100	1680		-	3780
	DUST INLET CYCLONE	2		300	.50	.40	150	120		-	270
	ROTARY DISCH VALVE (3/4 HP)	1		150	.40	-	60	-		1300	1360
	DISCHARGE SPOUT	1		100	.50	.40	50	40		-	90
	FEED SCREEN CONVEYOR 14" B	1		1150	.50	.10	580	120		240	310
	DISCHARGE SPOUT	1		100	.50	.40	50	40		-	90
	BRIGUETTE MACHINE & HOPPER	1		8000	.20	.05	1600	400		50,000	52,000
	DISCHARGE SPLITTER CURTAIN	1		250	.50	.40	130	100		-	230
	DUST TIGHT ENCLOSURE	1		400	.100	.40	400	160		-	560
	VENT FAN & CYCLONE	1		200	.50	.40	100	80		2000	2180
	FEED SPOUT TO RECYCLE SCREEN	1		100	.50	.40	50	40		-	90
	RECYCLE SCREEN CONVEYOR 14" B	1		920	.50	.10	460	90		3010	3560
	DISCHARGE SPOUT	1		100	.50	.40	50	40		-	90
	2TON CAPTAIN OPERATED PIST.	1		200	.30	-	60	-		350	410
	BRIGUETTE PRESS SUPPORT	1		1400	.50	.40	700	560		-	1260
	MISC SCREEN CON. SUPPORTS	1		200	.50	.40	100	80		-	180
	BIN VIBRATORS	2		150	.50	.10	80	20		500	600
	PIPEWORK & DISTING	1	LOT	2000			-	-	3500	-	3500
	STEAM GENERATOR						300	-		540	840
	SUB.			19,920			7,020	3570	3500	59180	73,270

ENGINEERING DEPARTMENT, TORONTO

PROJECT NUMBER:

AREA NUMBER:

SHEET

4
2 OF 2

ACCOUNT NUMBER	DESCRIPTION	QUANT.	UNIT	TOTAL WEIGHT	UNIT COST		ESTIMATED COST				TOTAL
					LABOUR	MATERIAL	LABOUR	MATERIAL	SUB. CONTR.	EQUIP.	
	CORRUGATED IRON SHEET SUB			19,920			7020	3570	3500	59,180	73,270
	FREIGHT @ 15.00/1000								3000		3000
	TAXES NOT APPLICABLE										73,270
	ENGINEERING 7%								5750		5100
	CONSTRUCTION O.M.								6000		
	SUB						7020	3570	17,600	59,180	87,370
	CONSTRUCTION 10%								8740		8740
	TOTAL						7020	3570	26340	59,180	96,410

CAPITAL COST ESTIMATE

FALCONBRIDGE NICKEL MINES LIMITED

ENGINEERING DEPARTMENT, TORONTO

PROJECT: COMPACTION OF ARSENIOUS OXIDE DUST DESCRIPTION: ELECT. POWER & CONTROL PROJECT NUMBER: _____

LOCATION: GIANT YELLOWKNIFE SCHEME #1 Roll
NIERES COMPACTOR AREA NUMBER: _____

PREPARED BY: J. D. M. DATE: JAN 20/76 REVISION & DATE: _____ SHEET 5 OF 5

[illegible]

CAPITAL COST ESTIMATE

FALCONBRIDGE NICKEL MINES LIMITED

ENGINEERING DEPARTMENT, TORONTO

PROJECT: CONSTRUCTION OF ARSENIOUS OXIDE DUST DESCRIPTION: SUMMARY PROJECT NUMBER: _____
 LOCATION: GIANT YELLOWKNIFE SCHEME #2 AREA NUMBER: _____
 PREPARED BY: J.D.M. DATE: Jan 26/76 REVISION & DATE: _____ SHEET 1 OF 4

ACCOUNT NUMBER	DESCRIPTION	QUANT.	UNIT	TOTAL WEIGHT	UNIT COST		ESTIMATED COST				TOTAL
					LABOUR	MATERIAL	LABOUR	MATERIAL	SUB. CONTR.	EQUIP.	
	CIVIL WORK			10,000 #							29,400
	MECHANICAL WORK			11,000 #							91,230
	ELECTRICAL WORK			6,000 #							13,800
	FREIGHT			27,000		Use	2 TRUCK LOADS @ \$1000/LOAD				2000
	RESEARCH & DEVELOPMENT						ALLOW				\$10,000
	ENGINEERING 7%								SUB TOTAL		146,430
											10,250
									SUB TOTAL		156,680
	CONSTRUCTION OH & PROFIT 15%										23,500
									SUB TOTAL		180,180
	CONTINGENCY 10%										18,020
									TOTAL		198,200
							Use	\$200,000			

CAPITAL COST ESTIMATE

FALCONBRIDGE NICKEL MINES LIMITED

ENGINEERING DEPARTMENT, TORONTO

PROJECT: COMPACTION OF ARSENIOUS OXIDE DUST DESCRIPTION: CIVIL WORK PROJECT NUMBER:

LOCATION: GIANT YELLOWKNIFE SCHEME 2 AREA NUMBER:
MINES

PREPARED BY: J. D. M. DATE: JAN 21/75 REVISION & DATE: _____ SHEET 2 OF 4

COUNT NUMBER	DESCRIPTION	QUANT.	UNIT	TOTAL WEIGHT	UNIT COST		ESTIMATED COST				TOTAL
					LABOUR	MATERIAL	LABOUR	MATERIAL	SUB. CONTR.	EQUIP.	
	ROCK EXCAVATION	12,000	CUFT		Assume	1.25/cf					15000
	CONCRETE TURNHEAD	4	cys		Use	\$300/cy					1200
	DUST TIGHT DOOR 8'x8'	1	EA								1000
	CONCRETE SUPPORT BASES	6	cy			\$300 ⁰⁰ /cy					1800
	ALLOWANCE FOR ROCK ANCHORS & WIRE MESH	40	EA			\$10					\$400
	MISC FRAMING & EQUIP. SUPPORTS ETC	10,000	LBS			@ 100/lb					10,000
											29,400

ENGINEERING DEPARTMENT, TORONTO

PROJECT: _____ DESCRIPTION: ARGONIOUS OXIDE DUST PROJECT NUMBER: _____
LOCATION: GIANT YELLOWSTONE COMPACTION. (B) AREA NUMBER: _____
PREPARED BY: 4 USING HYDRAULIC RAMM. DATE: JAN 26 73 REVISION & DATE: _____ SHEET 3 OF 4

ACCOUNT NUMBER	DESCRIPTION	QUANT.	UNIT	TOTAL WEIGHT	UNIT COST		ESTIMATED COST				TOTAL
					LABOUR	MATERIAL	LABOUR	MATERIAL	SUB. CONTR.	EQUIP.	
	15' H x 6' Ø CONCRETE DISCH. BIN	1	#	4200	.50	.40	3100	1680		-	3780
	DUST INLET CYCLONES	2		300	.50	.40	150	120		-	270
	ROTARY DISCHARGE VALVE	1		150	.40	-	60	-		1300	1360
	DISCHARGE SPOUT	1		100	.50	.40	50	40		-	90
	FEED SCREEN	1		650	.50	.10	330	70		1500	1900
	COMPACTOR (COMP WITH HYDRA.)	1		3000	.20	.20	600	600		75000	76200
	DUST TIGHT ENCLOSURE	1		300	1.00	.40	300	120		-	420
	VENT FAN & CYCLONE	1		200	.50	.40	100	20		8000	2180
	SCREEN SUPPORT	1		100	.50	.40	50	40		-	90
	BIN VIBRATORS	2		150	.50	.10	80	20		500	600
	PIPEWORK & DUCTING	1	LOT	2000			-	-	3500	-	3500
	STEAM GENERATOR	1					300			540	840
	SUB.			11150			4120	2770	3500	80840	91230

CAPITAL COST ESTIMATE

FALCONBRIDGE NICKEL MINES LIMITED

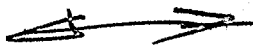
ENGINEERING DEPARTMENT, TORONTO

PROJECT: COMPACTION OF ARSENIOS
OXIDE DUST DESCRIPTION: ELECT. POWER & CONTROL PROJECT NUMBER: _____

LOCATION: GIANT YELLOWKNIFE MINES SCHEME #2 - HYDRAULIC PRESS AREA NUMBER: _____

PREPARED BY: J.D.M. DATE: _____ REVISION & DATE: _____ SHEET 4 OF 4

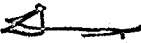
[illegible]

21604 NOTE THIS 
WHERE THIS GUY GOT THIS INFORMATION?

$$\frac{2000 \text{ lbs}}{40 \text{ lbs}} = 50 \text{ CF}$$

$$\frac{100}{115} = .87$$

OR 13%
UNKNOWN
FRICKING TO
BE KNOWN

INCORRECT. 
WHAT HE MEANT BY THAT?

CALCULATION SHEET
FALCONBRIDGE NICKEL MINES LIMITED

SIGNATURE J. D. M.

DATE Jan 27/76

TITLE GIANT YELLOWKNIFE MINES LTD

JOB No. _____

SUBJECT COMPACTION OF ARSENIC

SHEET No. _____

ANNUAL - OPERATING COSTS & SAVINGS (Roll Compactor)

ANNUAL CAPACITY = $360 \text{ DAYS} \times 15 \text{ TONS/DAY} = \underline{5400 \text{ T/yr.}}$

$5400 \text{ T} \times 2000 = 10,800,000 \text{ lbs}$

- Assume:
1. Maximum Density presently achieved in U/G fill areas is 40 lbs/cf.
 2. Minimum Density that could be achieved in U/G fill areas is 30 lbs/cf
 3. Maximum Density that could be achieved in U/G fill areas is 100 lbs/cf
 4. Maximum Density achieved in rolling tests was 115 lbs/cf

ANNUAL LIVE STORAGE REQUIRED UNDER ABOVE CONDITIONS ARE:

CONDITION #1	$10,800,000 \text{ lbs} \div 40 =$	$270,000 \text{ cu ft}$
#2	$" \div 30 =$	$135,000 \text{ " "}$
#3	$" \div 100 =$	$108,000 \text{ " "}$

Assuming: LIVE STORAGE Vol = 0.7 x DEAD STORAGE Volume

USE A COST OF DEAD STORAGE VOLUME = \$0.70/cf.

" COST OF LIVE STORAGE VOLUME = $0.70 / 0.7 = \underline{\$1.00/cf}$

SAVINGS PER YEAR BEFORE DEDUCTION OF OPERATING & MAINTENANCE COSTS

MAXIMUM = $(\#1 - \#3) = 270,000 - 108,000 = 162,000 \text{ cu ft} \times \$1.00/\text{cf} = \underline{\$162,000.}$

MINIMUM = $(\#1 - \#2) = 270,000 - 135,000 = 135,000 \text{ cu ft} \times \$1.00/\text{cf} = \underline{\$135,000}$

CALCULATION SHEET

FALCONBRIDGE NICKEL MINES LIMITED

SIGNATURE J. D. M.DATE Jan 27/76TITLE GIANT YELLOWKNIFE MINES

JOB No. _____

SUBJECT COMPACTION OF ARSENIC

SHEET No. _____

ANNUAL OPERATING COST & SAVINGS (CONT.)

ANNUAL OPERATING COST (ROLL COMPACTOR)

① POWER =

$$105 \text{ HP} \times .745 \frac{\text{HP}}{\text{kW}} \times 60\% \text{ E.F.} \times 6 \text{ HR/DAY} \times 5 \frac{\text{D}}{\text{WK}} \times 52 \text{ WK/YR} \times 1.5 \text{¢/KWH}$$

$$= \$1,300 \text{ / YEAR}$$

② OPERATING PERSONNEL =

$$\text{Assume } 1 \text{ man} \times 3 \text{ HR/DY} \times 6 \frac{\text{D}}{\text{WK}} \times 52 \text{ WK/YR} \times \$6.50/\text{HR} \times 1.4 \text{ FR.}$$

$$= \$8,500 \text{ / YEAR}$$

③ MAINTENANCE PERSONNEL

$$\text{Assume } 20 \text{ HR/WK} \times 52 \text{ WK/YR} \times \$7.50/\text{HR} \times 1.4$$

$$= \$11,000 \text{ / YR}$$

④ SPARE PARTS

$$\text{Assume } 10\% \text{ OF CAPITAL EQUIPMENT COST} = 0.1 \times \$59,000$$

$$= \$5,900 \text{ / YR}$$

TOTAL OPERATING COST = \$26,700 - Use \$27,000

SAVINGS AFTER DEDUCTION OF OPERATING & MAINTENANCE COSTS ARE

$$\text{Maximum} = 162,000 - 27,000 = \$135,000$$

$$\text{Minimum} = 135,000 - 27,000 = \$107,000$$

USING A CONSERVATIVE ^{ANNUAL} SAVING BEFORE TAXES OF \$200,000, AND DEPENDENT ON THE NO. OF YEARS THE EQUIPMENT IS DEPRECIATED, THE PAYOUT PERIOD IS LESS THAN 2 YEARS.

APPENDIX C

Equipment Data

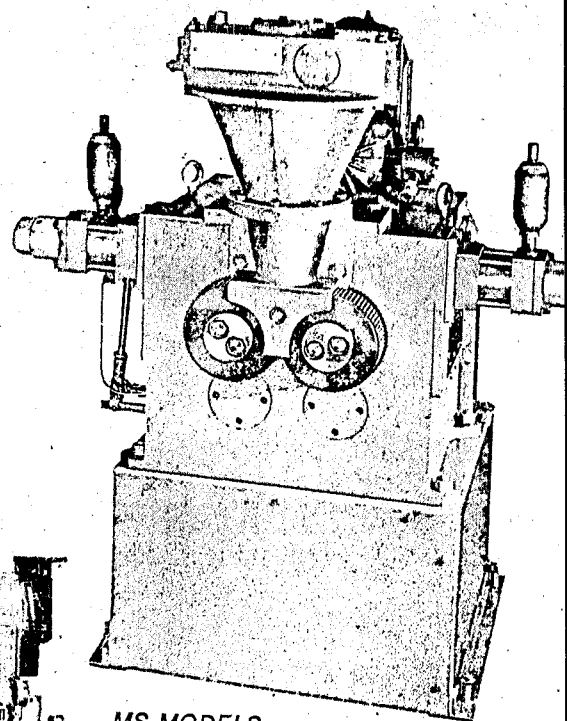
1. Roll Compactor
2. Pneumatic Plunger Compactor
3. Extruders

A COMPLETE LINE OF BRIQUETTING MACHINES FOR T

*Two types
of machines with
infinite
variations*

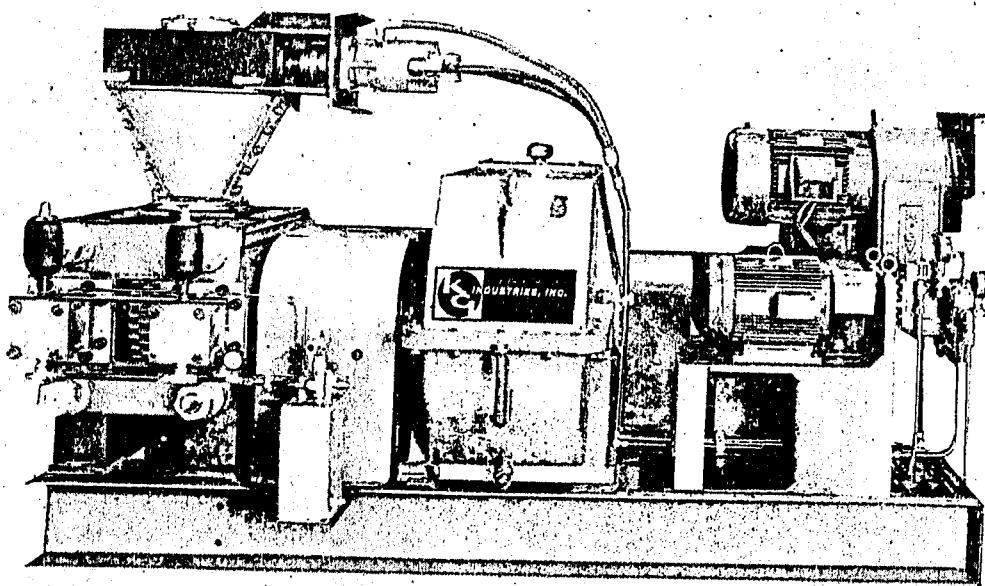
CS MODELS

Model CS machines have cantilever shaft design. The rolls are located outside the frame, allowing for easy roll changeover from smooth to corrugated to pocketed rolls. The Model CS machine is versatile and rugged.



MS MODELS

Model MS machines are Mill Shaft design. This means that both ends of the two roll shafts are carried on bearings within the frame of the machine, permitting greater roll force and hydraulic pressure control on all four bearings. Larger, higher pressure machines are Mill Shaft machines.



APPROXIMATE DIMENSIONS—MODEL MS AND CS MACHINES

MODEL	Max. Roll Separating Force (Tons)	Roll Diameter	Roll Face Width	Overall Dimensions			Weight Lbs.
				Height	Width	Length	
MS	50	10.3	4	6' 0"	3' 6"	8' 0"	9,900
	50	10.3	6				
	75	20.5	4.7	7' 10"	5' 2"	9' 10"	20,000
	75	20.5	6				
	75	20.5	8				
	75	28	4.7				
	75	36	6				
	150	20.5	6	7' 10"	6' 6"	10' 0"	25,000
	150	20.5	9.2				
	150	20.5	11.2				
	200	28	18	6' 4"	8' 1"	12' 6"	32,000
	300	28	10	8' 4"	7' 11"	15' 6"	60,000
	300	28	27				
METAL- MASTER (Model 720)	350	36	10	9' 0"	17' 1"	18' 0"	120,000
	360	28	10	8' 4"	7' 11"	15' 6"	60,000
	360	36	10	9' 0"	8' 8"	15' 6"	64,000
CS	25	9	3	5' 3"	3' 6"	3' 6"	4,000
	25	16	4.7				
	50	16	4.7	7' 4"	8' 6"	8' 4"	14,000
	75	20.5	6	7' 4"	8' 10"	9' 0"	24,000

S. H. DESIGN and Service Co. Ltd.

5015 Maingate Drive, Unit 1
Mississauga, Ontario L4W 1G4
(416) 625-5296

November 11, 1975

Falconbridge Nickel Mines Limited
P. O. Box 40, Commerce Court West
Toronto, Ontario M5L 1B4

Attention: Mr. J. D. Morrison

Gentlemen:

During my recent visit to your office, we agreed to confirm our proposal regarding your waste disposal project. The material to be disposed of is arsenic powder with an approximate density of 25 lbs. per cubic foot. The machinery will be required to compress the powder to the density of 115 lbs. per cubic foot (or whatever can be obtained within the budgetary figure). Your original idea of an extruder does not seem to be feasible for several reasons in our opinion.

We are proposing a hydraulically -operated, plunger-type compactor to produce compact cakes of arsenic powder. The machinery will be designed to dispose of 20 tons of material in 7 hours time span. The material will be fed into the compactor by a screw conveyor which will be pre set for exact volume per stroke. The hopper of the screw conveyor can be directly attached to your cyclone. The compactor air bleed will be fed back to the conveyor hopper. The screw conveyor will be provided with a steam inlet to provide the necessary dampness for compacting. The cakes will be automatically ejected from the machine. The entire system will be totally enclosed for safe operation, and will have an electrically driven 50 HP hydraulic power unit.

Estimated price complete on a platform is \$75,000.00 f.o.b. our plant.

For the best results, a laboratory test should be conducted to obtain the best compression pressure and to determine the abrasiveness of the material. The compression test will require a special laboratory machine. S.H. Design will design and build a pneumatically operated unit for \$1,700.00. The cost of the test and the preparation of a report will be approximately \$1,200.00, which amount will be refundable from the price of the actual machine.

...2

Falconbridge Nickel Mines Limited

November 11, 1975

Page 2

Test time will be 6 to 8 weeks including manufacturing of the test equipment.

Machine design and manufacturing time will be 6 to 7 months.

Payment terms:

*40% with the order,
30% upon completion of project,
30% Net 30 days*

S.H. Design fully guarantees the function of the machinery as will be specified at the time of ordering.

Thank you for your interest in our company and we hope that the above will assist you with your project. If there are any questions, or if we can be of further assistance, please do not hesitate to call us.

Yours very truly,

S.H. DESIGN and SERVICE CO. LTD.



*Steven J. Horvath
President*

SJV:mb

cc Mr. Lionel Hurst

40% sales
manufactured in
plants

20 employees - 10 managers
annual sales \$1.5 - 2.0 x 10⁶
plant 6000
3 ft

THE COMPANY...

S. H. DESIGN AND SERVICE COMPANY LTD. IS AN ENGINEERING FIRM ENGAGED IN A WIDE VARIETY OF SERVICES, SUCH AS PRODUCT DESIGN, PRODUCT EVALUATION, PRODUCTION FEASIBILITY, EQUIPMENT RECOMMENDATION, EQUIPMENT SELECTION, MACHINERY DESIGN, MACHINERY SUPPLY, AND OTHER SERVICES RELATED TO THE INDUSTRY, WHICH COULD INCLUDE:

- A) CONSULTATIONS, EVALUATIONS, ADVICE.
- B) COMPLETE SET OF DESIGNS FOR PRODUCTS, PRODUCTION MACHINERY, OR INDIVIDUAL EQUIPMENT.
- C) EQUIPMENT MANUFACTURED TO SPECIFICATION.

THE WIDE EXPERIENCE OF OUR STAFF ENABLES US TO CONFRONT INDUSTRIAL PROBLEMS WITH HIGH CONFIDENCE. MANY OF THE MACHINERY DESIGNED BY OUR STAFF IS USED AND KNOWN WORLD-WIDE (UNITED STATES, JAPAN, SWEDEN, BRITAIN, ETC.).

OUR COMPANY IS ENJOYING A VERY CLOSE RELATIONSHIP WITH SOME OF THE BEST MANUFACTURERS IN ORDER TO PROVIDE EQUIPMENT OF THE HIGHEST INDUSTRIAL STANDARD.

SOME PRODUCTION MACHINERY DESIGNS HAVE PROVIDED OUR CUSTOMERS WITH A GREAT ADVANTAGE OVER THEIR COMPETITORS BY SOPHISTICATED, MODERN, AUTOMATED PRODUCTION EQUIPMENT. DESIGNED BY OUR COMPANY, SOME OF WHICH IS EVEN PATENTABLE.



**Fast out-of-town services are
ensured by company AIRPLANE**

Falcon Bridge Willard Lines Ltd.

Jim Morrison. 803.
683-7205.

20, tons of Atomic powder.

3-1/2 inches.

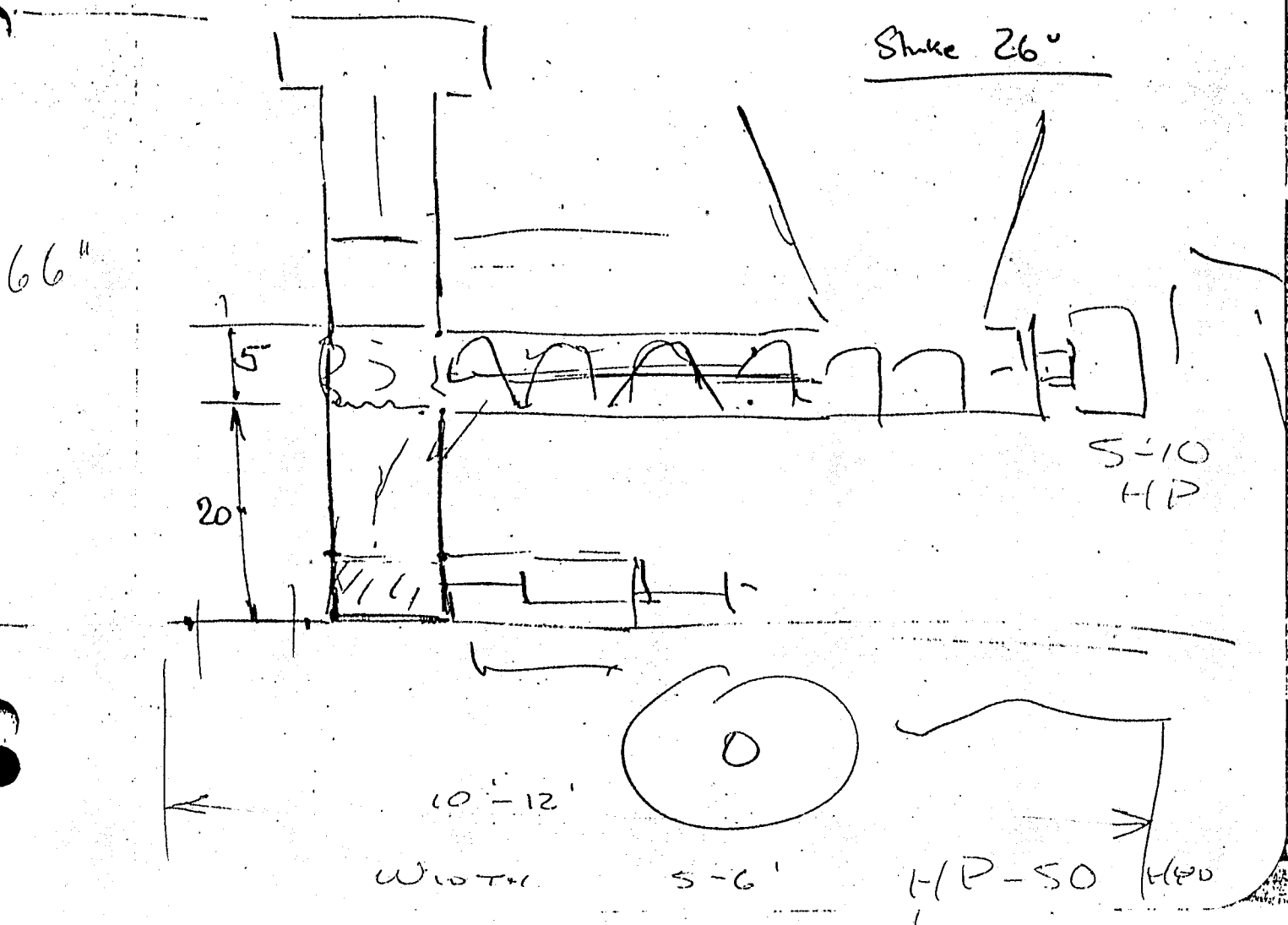
25 lbs/cubic foot \rightarrow 115 lbs/cubic foot.

estimated 1500 PSI. for compression.

20 TONS \rightarrow

\rightarrow 1600 cubic feet \rightarrow 348 cubic feet.

Compression Ratio: 4,6:1



8" Cylinders → 56 strokes.

1000 cubic inch / stroke at 20% stroke compression.

56 cubic feet / stroke.

2857 stroke / day for 1600 cubic feet.

360 stroke / ~~hour~~ / 2 HRS.

6 stroke / hour.

Oil. 8" Cylinders.

$50 \times 26 \times 6 = 7800$ cubic inch / min.

4.5 cubic foot / min.

31.5 Gallon / min.

~ 35 HP Powermin

POSSIBLY - ADD STEAM THEN SCREW

CONTACTS FULL RANGE OF WATERING

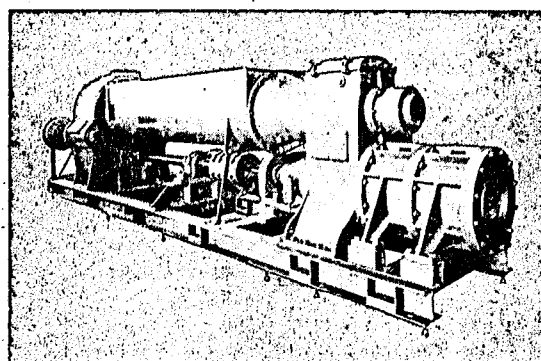
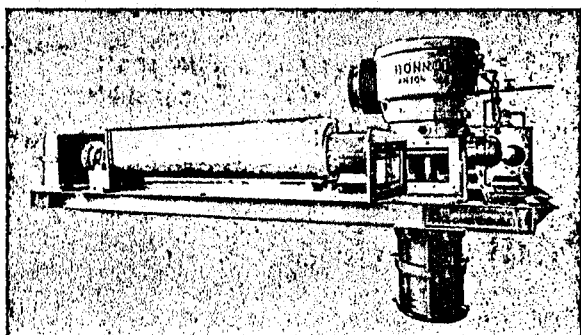
COMPLETELY (NEEDS)

CONCRETE ESTIMATE \$75,000

TEST LETTER OF PROPOSAL

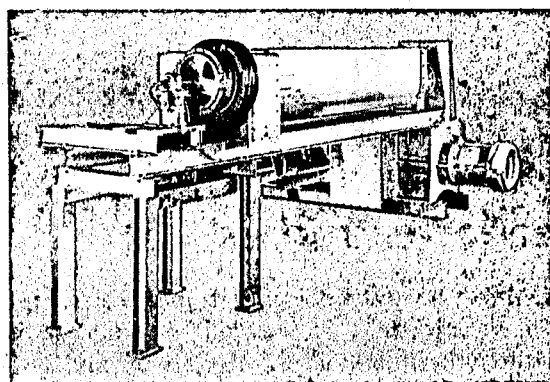
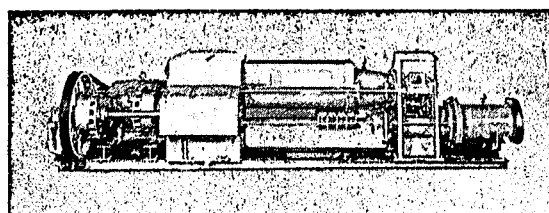
structural clay products refractories tile & pipe

BONNOT designs incorporate single reduction gear boxes arranged for either single or dual drives, fixed or variable speed. Rugged high strength castings . . . oversize flame hardened helical gearing . . . high carbon and alloy shafting and hi-chrome augers. Capacities and power ratings are given as a guide for selection of sizes and are based on average practice at 35 RPM of auger shaft for continuous operation.



MODEL	PUG TUB	AUGER DIA.	H.P. RATING	CAPACITY C.F./Hr.
Pacemaker	20" x 7'	10"	50	80 C.F./hr.
Challenger	24" x 7'	12" - 16"	100	300
Greyhound	30" x 12'	16"	300	750
Imperial	36" x 12'	18"	350	1200
Vertical Imperial	36" x 12'	18"	350	1200

CHAMBERS DIVISION models feature double reduction gear boxes . . . welded steel construction . . . independent pugmill clutches and two level independently driven combined machines. Rated and powered for continuous operation at 35 RPM of auger shaft. Weldments stress relieved, shafting alloy steel, gearing flame hardened cut teeth, helical and spur . . . wearing parts Hi-Chrome castings.



MODEL	PUG TUB	AUGER DIA.	H.P. RATING	CAPACITY C.F./Hr.
#6-C	12" x 6'	8"	35	60
#7-C	18" x 8'	10"	75	100
#9-C	21" x 9'	12 5/8"	125	300
#11-AC	28" x 12'	16"	250	650
#2-11	28" x 12'	16"	250	650
#12-AC	28" x 12'	16-18"	300	900
#2-12	28" x 12'	16-18"	300	900

On the two level machines a twin tub pug mill can be furnished effectively doubling the pugging action.

EXTRUSION DIES . . . Alloy castings with provision for lubrication with oil either one piece construction or combination "die base" and bolted on "shaper cap". The dies are generally of the "slip in" type fitting our single or double hung die holders, or can be made so as to bolt directly to the extruder barrel. Hi-Chrome castings for maximum service life. Dies are made to conform to any required cross section and may be cored for hollow ware.