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AUTOMATION OF SMALL AND MEDIUM-SCALE INDUSTRIES

DP/ROK/87/001

REPUBLIC OF KOREA

Technical report: Design of special purpose automation machinery *

Prepared for the Government of the Republic of Korea
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Joe Minkwitz
Expert in Low Cost Automation

Backstopping officer: P. Prijapratama
Engineering Industries Branch

United Nations Industrial Development Organization
Vienna

3a/13

* This document has not been edited.

V.89-58293

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A. ITINERARY

Date	Day	Work Class	Name of Company	Location	Contents
4- 2	Sun.	Arrive		Seoul	P. M.
4- 3	Mon.	Meeting	UNDP, SMIPC	Seoul	Report to UNDP Discuss Problem areas, Introduction
4- 4	Tue.	Visit	Royal Metal Ind.	Bucheon	Nail Clippers
4- 5	Wed.	Rest	Holiday	Seoul	
4- 6	Thu.	Visit	Korea Automatic	Buyung	Automation Manufg.
4- 7	Fri.	Consult.	Chang Dae L.T.D.	SEOUL	Robotic Components
4- 8	Sat.	Other	S.M.I.P.C.	Seoul	Summerize Visits, Study, etc.
4- 9	Sun.	Rest		Seoul	
4-10	Mon.	Travel	From Seoul to Pusan		
4-11	Tue.	Visit	Life Engineering	Pusan	Connecting Rod for Refriger. Compressor
4-12	Wed.	Travel	From Pusan to Ulsan		
4-13	Thu.	Visit	Sam Joo Co. LTD.	Ulsan	Transmission gear shift fork
4-14	Fri.	Consult	Sam Joo Co. LTD.	Ulsan	Indexing Machine and Shot Pin Mechanism
		Travel	From Ulsan to Seoul		
4-15	Sat.	Other	S.M.I.P.C.	Seoul	Summerize Visits, Report, Discussion
4-16	Sun.	Rest		Seoul	
4-17	Mon.	Concult	Korea Automatic	Bupyung	Indexer & shot pin
4-18	Tue	Design	Royal Metal Co.	S.M.I.P.C.	Nail Clipper
4-19	Wed.	Consult	Royal Metal Co.	Bucheon	Present designs and discussed operation
4-20	Thu.	Consult	Tae Jin Co.	Ansan	Auto. load mechanis for thead rollers
4-21	Fri.	Meeting	UNDP, SMIPC	Seoul	Report to UNDP
4-22	Sat.	Depart	SMIPC	Seoul	Report and Depart

B. INTRODUCTION

Briefing.

The mission began on monday April 3rd 1989 at S.M.I.P.C. in Seoul, Korea with a short introduction to some of the new members of the organization, who have joined the "Automation" group during the last 12 months.

Since this was my fifth trip to S.M.I.P.C. in Seoul, the normal preparations that are necessary for a "First Time Visitor", were cut short and we were able to go right down to business.

I was introduced to Professor Geon Cha Kim of S.M.I.P.C. , who was assigned to be my partner and translator for the entire stay in Korea. And Mister K. D. Lee was assigned to be his assistant.

Together we went to the U.N.D.P. Office in Seoul and met with Mister P. C. Park, Programme Officer, who explained the relationship between S.M.I.P.C. and U.N.I.D.O.

Mr. Park expressed to me that several companies of small and medium size are in great need for service of experts in the field of automation.

He asked us to complete the scheduled projects and assignments first before we attempt to work on any others during my stay. And we all agreed that that is the plan we will stick to.

I was told that there were five project areas that need the attention of an expert and they are:

1) Drilling (Special purpose machine)

2) Material handling automation

3) Work holding fixturing (Spec. purp. machine)

4) Machining (Special purpose machine)

5) Belt grinding (Special purpose machine)

I told the gentlemen that I am very familiar with all of those areas.

Mission

The actual working session began on Monday April 3rd after I returned to S.M.I.P.C. from U.N.D.P. and ended on Saturday April 22nd, covering a period of three weeks with visits to six companies, addressing several problems during each visit, spanning a wide variety of different applications.

During this period I was working with Professor G. C. Kim and Mister K. D. Lee, who were my translators and partners during my entire stay in Korea.

I have to say that both gentlemen are a great asset to S.M.I.P.C. as well as the small and madium companies they service. Both men are very different in personnality but they work good together as a team. I was impressed how well the two complement each other and how well the three of us were able to function in a customer's plant. They made me feel very welcome and proud to be one member of their team.

As far as the S.M.I.P.C. Automation department goes, I was impressed with the progress that was made in the department during the last five years under the direction of Mister Nam. I have noticed progress every year when I came back for a visit.

I am sure that some of the progress can be traced back to the assistance of foreign experts that have left some of of their knowledge and skills with their korean counter parts, thanks to U.N.I.D.O. and S.M.I.P.C. international.

I have enjoyed the team work with Professor G. C. Kim and Mister K. D. Lee and would be honored to serve S.M.I.P.C. again in the future.

Serving S.M.I.P.C. and their clients in Korea gives me a feeling of appreciation, worth and accomplishment.

Debriefing and follow-up

Before leaving Korea, I had a short meeting with Mister P. C. Park at U.N.D.P. in Seoul. It was a pleasure to communicate with him directly without having to go through a translator. Mister Park has a very good and clear pronunciation in the english language. We discussed some of the projects and the recommendations. I reported to Mister Park that we completed some of the assignments sooner than scheduled and we were able to take on some projects that were not on the original schedule.

Mister Park expressed that he would like to have me return to Korea as soon as possible to work on additional projects in other companies.

I replied that I may be able to return in September of this year and I would let U.N.I.D.O. know as soon as I can finalize my office work schedule for the fall of 1989.

After my return from Korea I was in contact by phone with Mister Y. J. Park in Chicago and filled him in with all our activities during my stay in Korea.

One of the automation team members in Seoul asked me is I could get him some information about a "Thread inserting" machine and another member asked for a "Camco indexer" catalog. I arranged for all this information to be sent to Mister Park in Chicago, who would forward it to the "Automation Department at S.M.I.P.C. in Seoul.

The above information was required for some of the projects we worked on in Korea as well as projects that other associates were assigned to.

C. ACTIVITY

An account of the companies visited, the problems presented/discussed and the advisory recommendations.

ROYAL METAL COMPANY

(Production of Nail Clippers)

The problem area of the production was identified as the semi-finish and finish grinding operation of the cutting edge of the clippers.

At the present time this operation is done manually and requires a skillful operator, an operator who is not only skillful but also consistant.

The clipper is being ground in the assembled state by squeezing the handle gently while the edge is presented to a grinding belt. With a sweeping motion along a tool rest while the handle of the clipper is being squeezed, the operator puts on the cutting edge with the grinding belt with a skillful steady hand.

After discussing the present production method of the clipper assembly, I was told by Mr. G.S. Kim, Product Manager and Mr. K.T. Jeon, Section Chief, that they are looking only for suggestions to make a single station fixture that will hold the Finger Nail Clipper in place during grinding. This fixture should be mounted on a slide so that it can move the part toward the grinding belt. At that time another cylinder should apply pressure of approximately .75 to .85 kg. during the first stages of grinding operation. After a predetermened time this pressure has to increse to 2.3 to 2.8 kg. The two different pressures during the grinding operations are needed to create the correct deflextion, simulating the conditions for normal use by customers.

It is my opinion that a single station fixture as requested by the customer will not be able to keep up with production requirements. Even if the operator will be operating 4 or 5 of these single station fixtures.

I have expressed my opinion to the customer and suggested the following:

A continues motion dial plate with approximately 24 fixtures on it equally spaced around the perimeter. Each fixture will be unloaded and loaded again by one operator. The dial plate is mounted on the output shaft of a gear reducer. As the fixtures leave the unload/load station, a camfollower cam will cause the fixture to clamp and a cam operated valve will apply the low and high pressures needed during the grinding operation. The dial plate mounted fixtures are floating in the direction of the able center at this point until a sizing bar has placed the loaded fixture in to the correct position. The fixture will be locked into position by a spring loaded clamp and the part is now ready to be ground. After low and high pressure grinding, the fixture will unclamp and the operator removes the finished part and loads the fixture again.

The above will take up 180° or less of the dial plate.

The same operations can be duplicated in the other 180° of the dial plate. (see sketch #1)

We also discussed compensation of grinding belt wear. Both grinding stations can be moved in "x" and "y" direction for compensation. This movement can be done manually or automatically by number of cycles.

If additional production is needed, the operations can be duplicated again and three operators can be placed 120° apart. (see sketch #2). With the method of three (3) operators the production rate is estimated at 200 to 300 parts per minute. This depends on the speed of the operators loading and unloading capability.

I have designed a typical fixture in full scale so the customer can physically see how this concept works on paper.

Copies of the fixtures design are shown as sketches #3, #4, #5.

Sequence of operation is as follows:

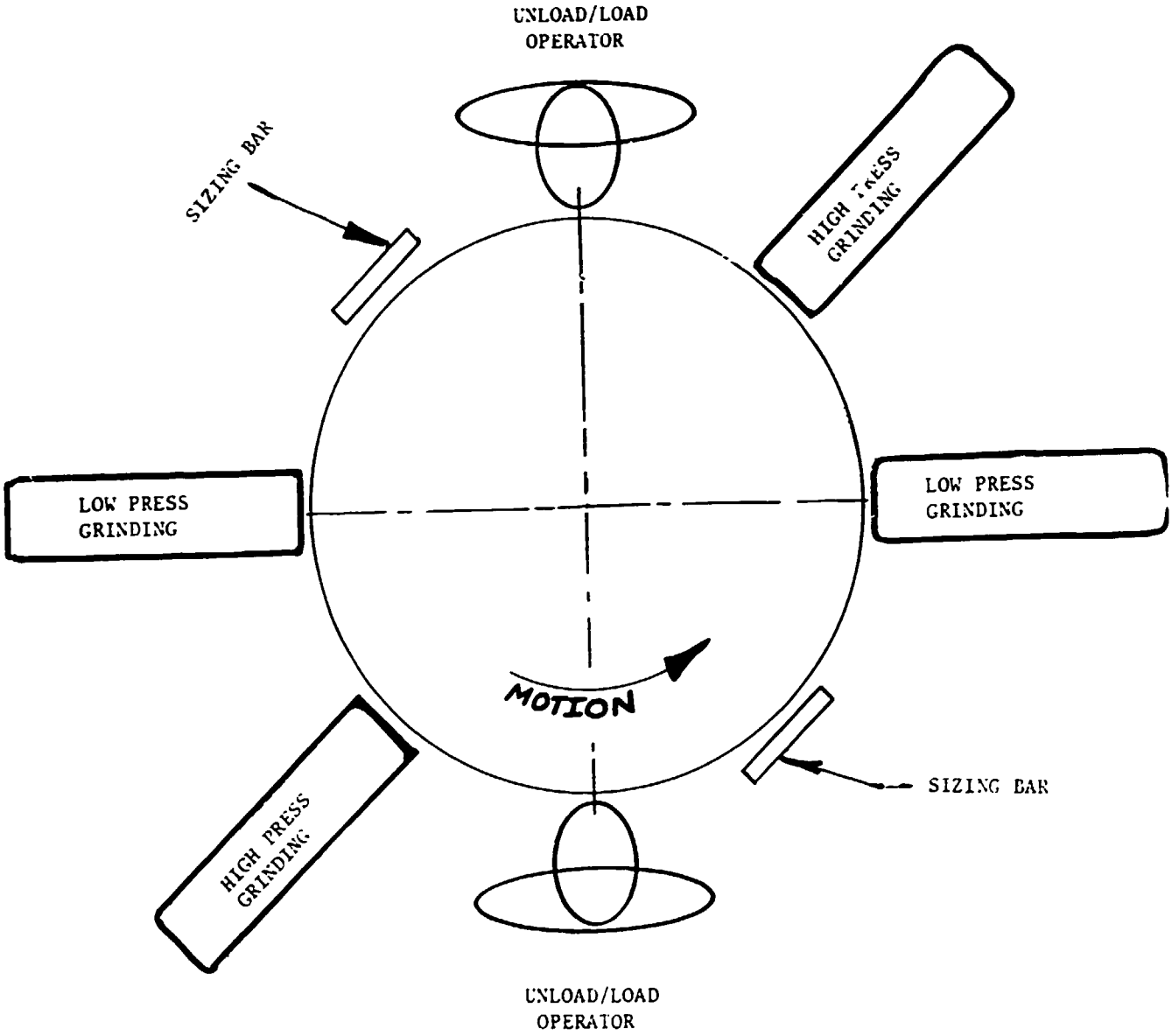
1) Load.
2) Pressurize with low press. .8 kg.(21 P.S.I.)
3) Position fixture with sizing bar and clamp to dial.
4) Grinding with low pressure.
5) Pressurize with high press. 2.6 kg.(67 P.S.I.)
6) Grinding with high pressure.
7) Unloading and loading of new part.

NOTE:

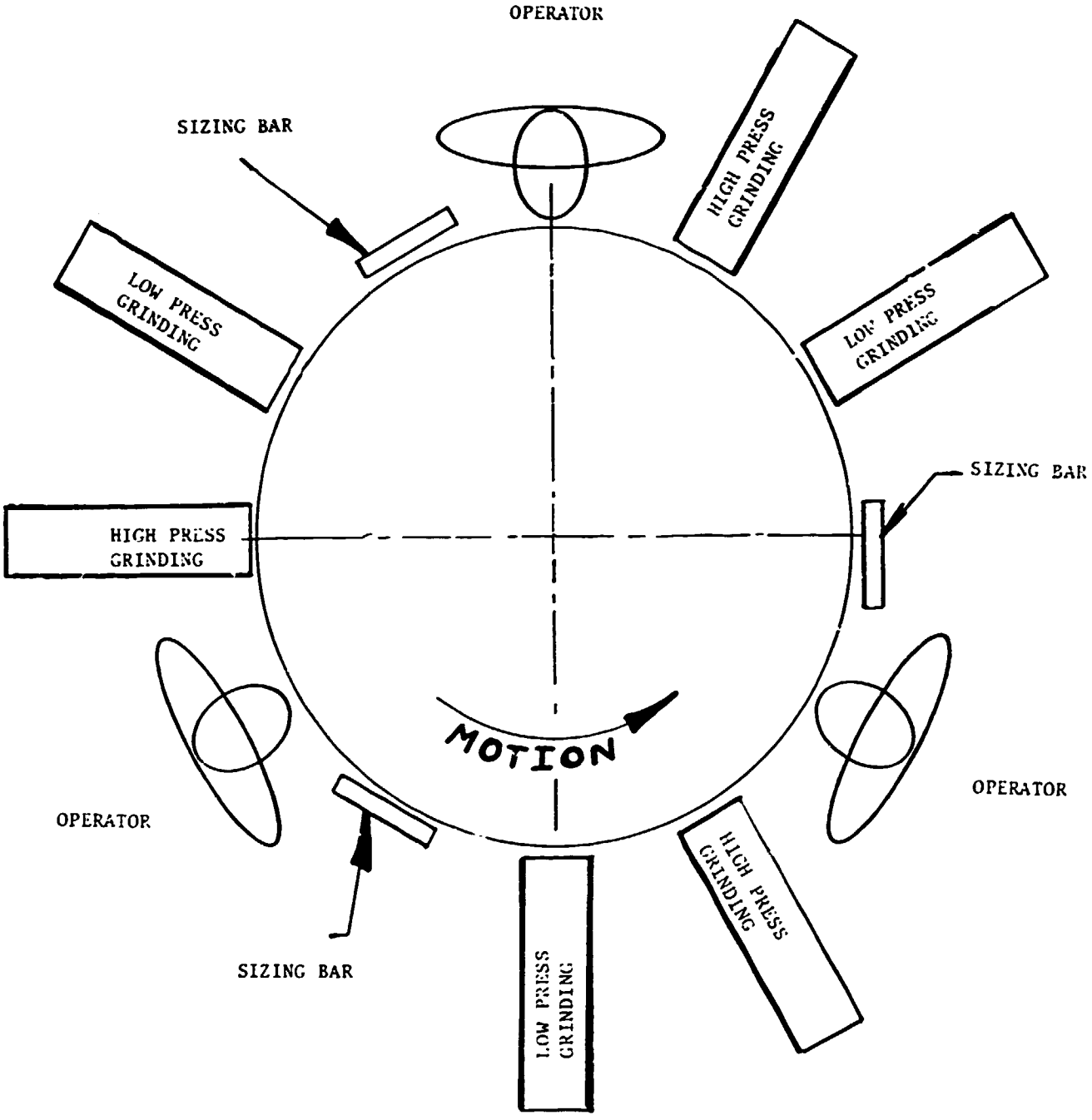
Parts loaded by operator #1 will be unloaded by operator #2, parts loaded by operator #2 will be unloaded by operator #3, parts loaded by operator #3 will be unloaded by operater #1. Etc

(See sketch #2)

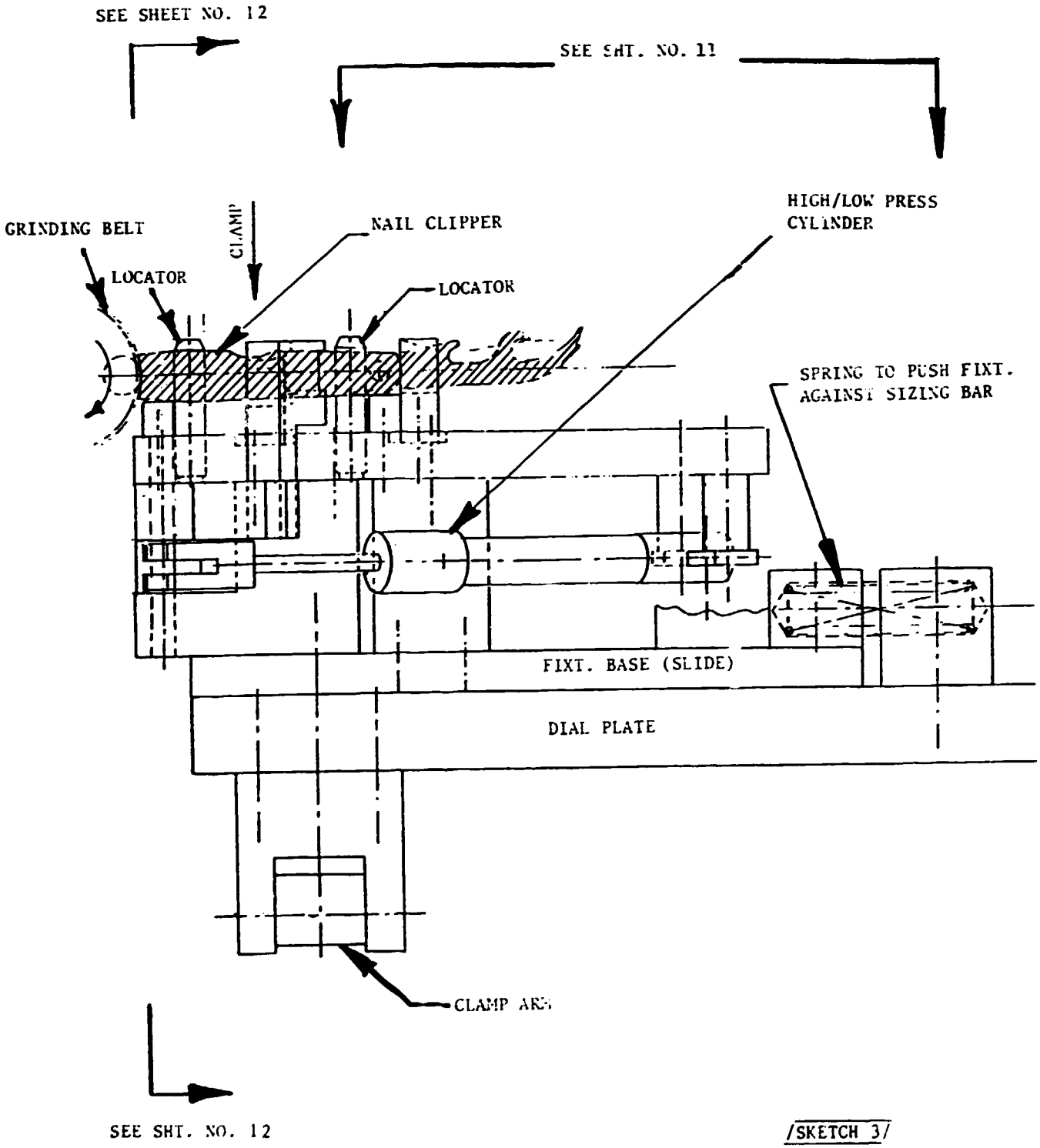
After presentation of the above concept, Mister K. T. Jeon revealed to me that several other "Experts" have attempted to solve this grinding operation problem but this was the first concept they feel will work. They can see clearly how it works on paper.


UNLOAD/LOAD
OPERATOR
SIZING BAR
HIGH PRESS
GRINDING
LOW PRESS
GRINDING
LOW PRESS
GRINDING
MOTION
SIZING BAR
HIGH PRESS
GRINDING
UNLOAD/LOAD
OPERATOR

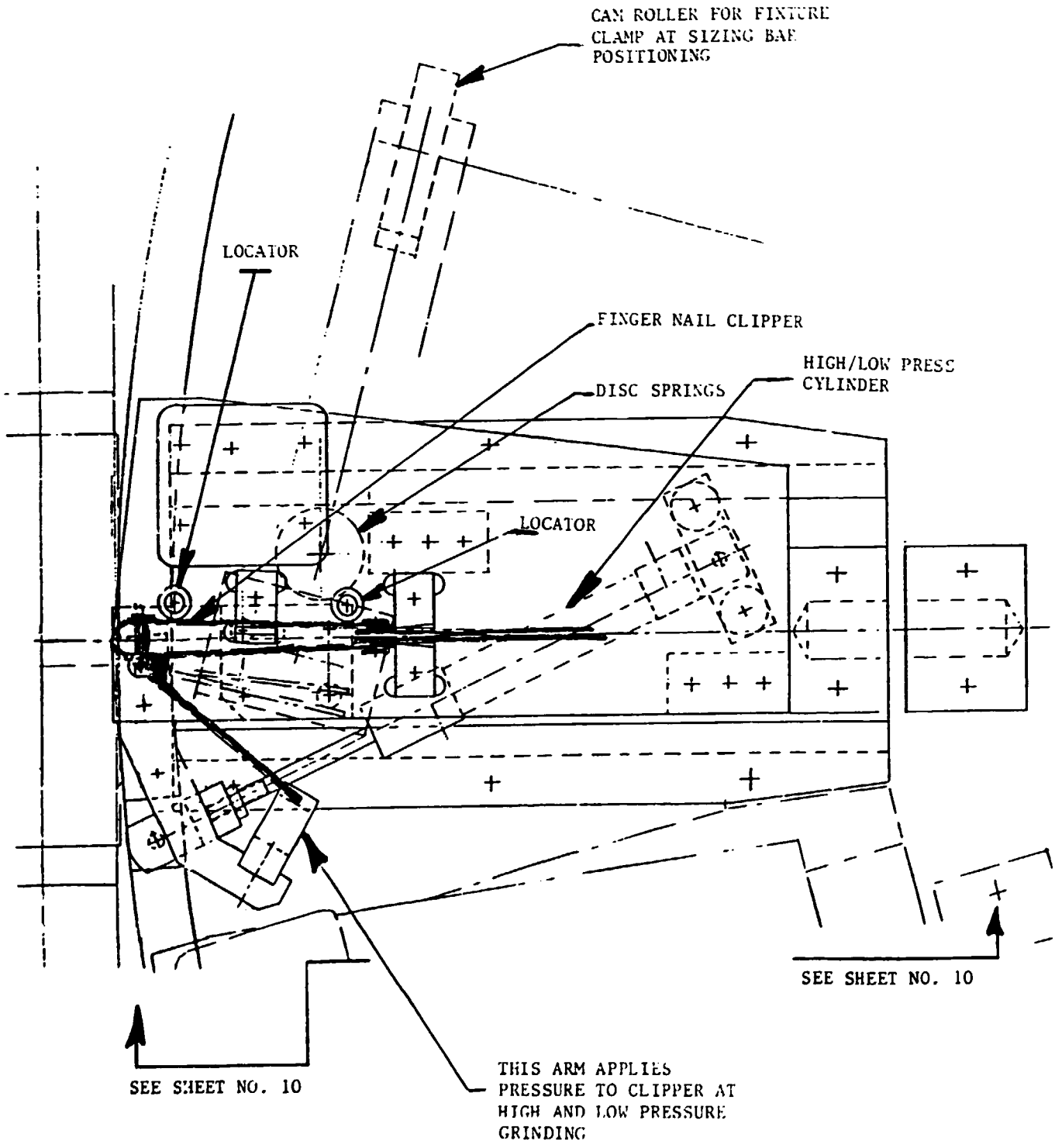
/SKETCH 1/


OPERATOR
SIZING BAR
HIGH PRESS GRINDING
LOW PRESS GRINDING
LOW PRESS GRINDING
SIZING BAR
HIGH PRESS GRINDING
MOTION
OPERATOR
OPERATOR
SIZING BAR
LOW PRESS GRINDING
HIGH PRESS GRINDING

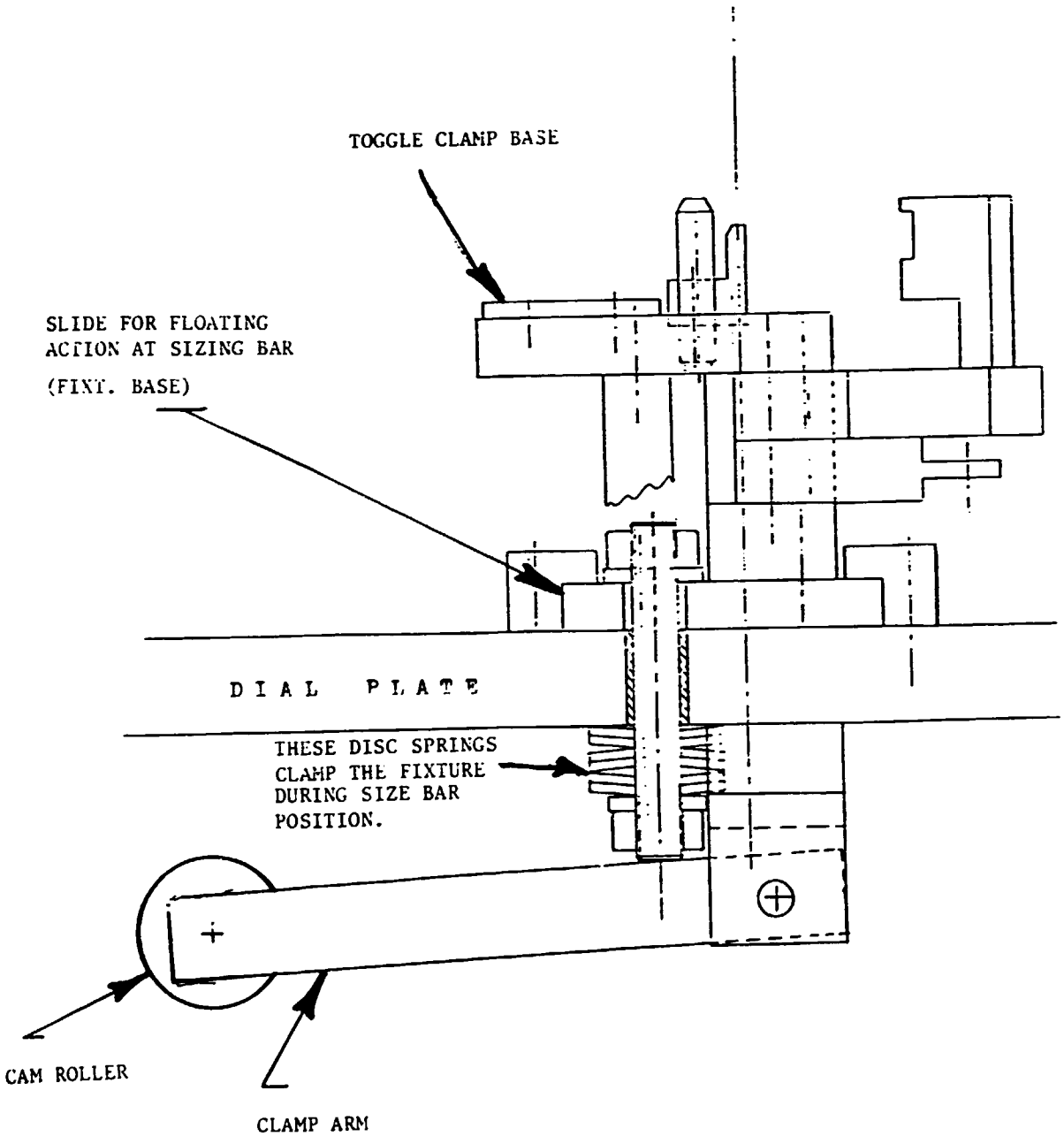
/SKETCH 2/


SEE SHEET NO. 12
SEE SHT. NO. 11
GRINDING BELT
CLAMP
NAIL CLIPPER
HIGH/LOW PRESS CYLINDER
LOCATOR
LOCATOR
SPRING TO PUSH FIXT. AGAINST SIZING BAR
FIXT. BASE (SLIDE)
DIAL PLATE
CLAMP ARM
SEE SHT. NO. 12

/SKETCH 3/


CAM ROLLER FOR FIXTURE CLAMP AT SIZING BAR POSITIONING
LOCATOR
FINGER NAIL CLIPPER
HIGH/LOW PRESS CYLINDER
DISC SPRINGS
LOCATOR
SEE SHEET NO. 10
SEE SHEET NO. 10
THIS ARM APPLIES PRESSURE TO CLIPPER AT HIGH AND LOW PRESSURE GRINDING

/SKETCH NO. 47


TOGGLE CLAMP BASE
SLIDE FOR FLOATING
ACTION AT SIZING BAR
(FIXT. BASE)
DIAL PLATE
THESE DISC SPRINGS
CLAMP THE FIXTURE
DURING SIZE BAR
POSITION.
CAM ROLLER
CLAMP ARM

/SKETCH NO. 5/

KOREA AUTOMATIC MACHINE COMPANY

(small drills in brass part)

After arriving, we visited the assembly floor and watched the (8) station indexing machine operate. Mr. Y.H. Lee, President of the company explained the function of the machine while U.N.D.O. camemera crew took videos. (I had never seen this machine before)

Afterwards we met in Mr. Lee's office and discussed problems with the machines and tried to come up with suggestions to remedy them.

One of the problems was accuracy and repeatability.

I suggested a rectangular shot pin with the positive side adjustable with fitting spacer. One shot pin for the machine and (8) shot pin nests. (one per station) See sketch #6 on page #17.

I also suggested that if a round locator shot pin is used, it has to be releaved. See sketch #7 on page #18.

But this round type of shot pin locator is not as easily adjustable.

I also mentioned that the indexer should stop short of the final position and the shot pin should pull the dial plate into position the last few thousands of an inch. This means that the hardered adjustable positive locator spacer on the rectangular shot pin should be on the trailing end of the nest.
See sketch #6 on page #17.

Mr. Lee mentioned that tool pressure and clamping pressure is influencing the accuracy of the machine. I suggested to counter act tool pressure and clamping pressure in such a way that as little as possible strain will be put into the dial plate.

An additional project was discussed:

Four (4) holes are to be drilled into a brass flow control plate. The holes range from .8mm to 1.8mm Dia. Because of the production requirement of 1250 parts per hour (2.88 sec cycle). I suggested 3 parts per fixture per cycle on an (8) station indexing machine. (see sketch #9 on page #20)

Three (3) parts are oriented manually and placed into the three nests in each fixtures.
Depending on the customer, this operation in Station #1 can be performed automatically with feeder bowls and a placement device. Automatic clamping between Station #1 and Station #2 with a cam operated air valve. (see sketch #8 on page #19)

The sequence of operation is as follows:

Sta. #1 Load station.

Automatic clamping between Sta. #1 and Sta. #2 (Cam operated)

Sta. #2 Drill station.

This station will automatically drills one hole in each one of the three parts.

Sta. #3 Idle station.

This station provides room for the tool change in Sta. #2 and Sta. #4.

Sta. #4 Drill station.

This station is a duplicate station of Sta. #2, but it is positioned in such a way that two new holes are being drilled.

Sta. #5 Idle station.

This station provides room for the tool changes in Sta. #4 and Sta. #6.

Sta. #6 Drill station.

This station is a duplicate station of Sta. #2, but it is positioned in such a way that two new holes are being drilled.

Sta. #7 Drill station.

This station is a duplicate station of Sta. #2, but it is positioned in such a way that two new holes are being drilled.

Sta. #8 Automatic unload station.

This station will automatically unload all three parts into a chute. But depending on the customers requirements and the next operation, it can also unload the parts with a pick and place unit, placing the parts into a known position.

Below is the production rate requirement for the drilling machine.

Cycles

10,000 parts per each 8.oo hrs.

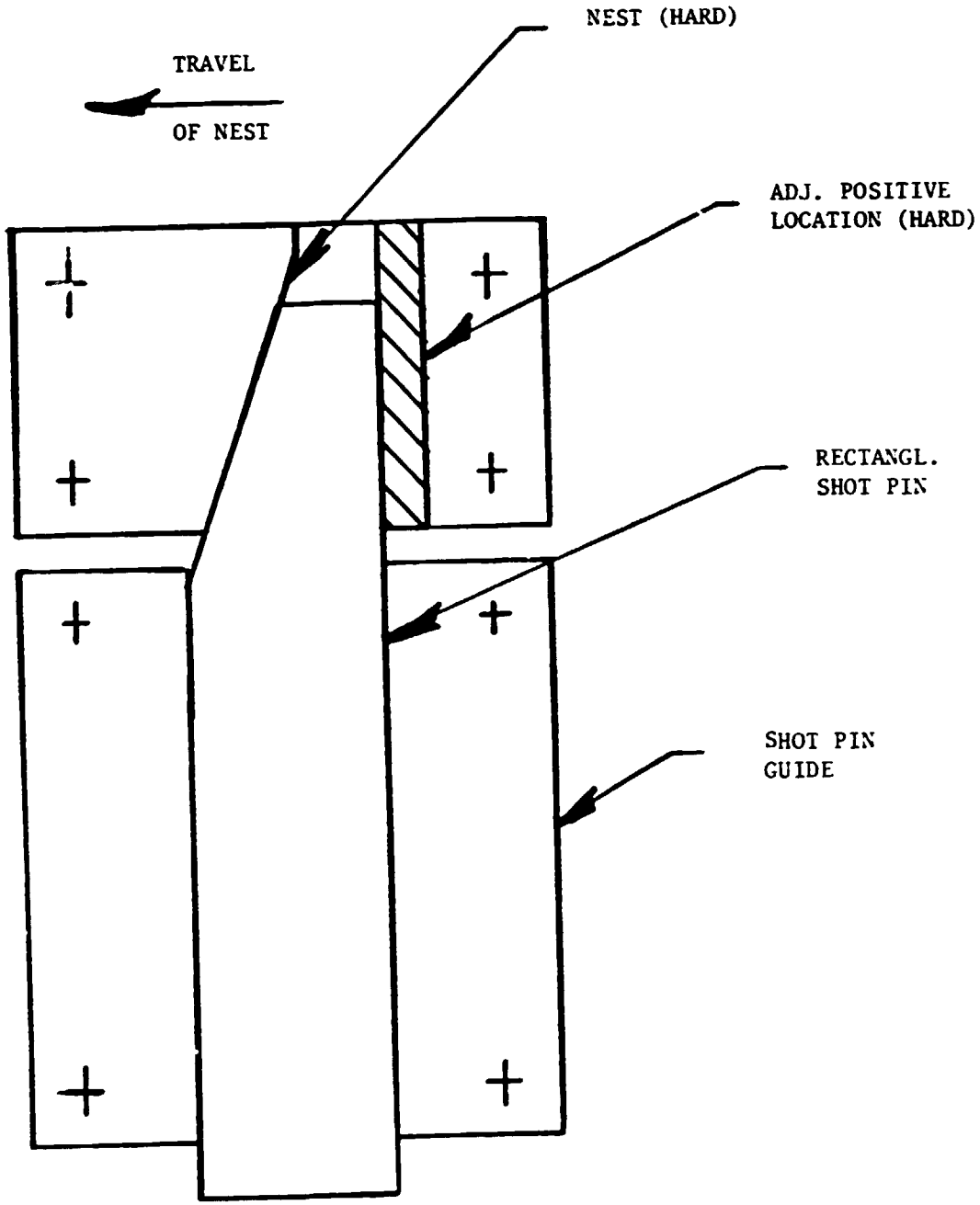
1250/Hr.

2.88 seconds cycle (If one per fixture)

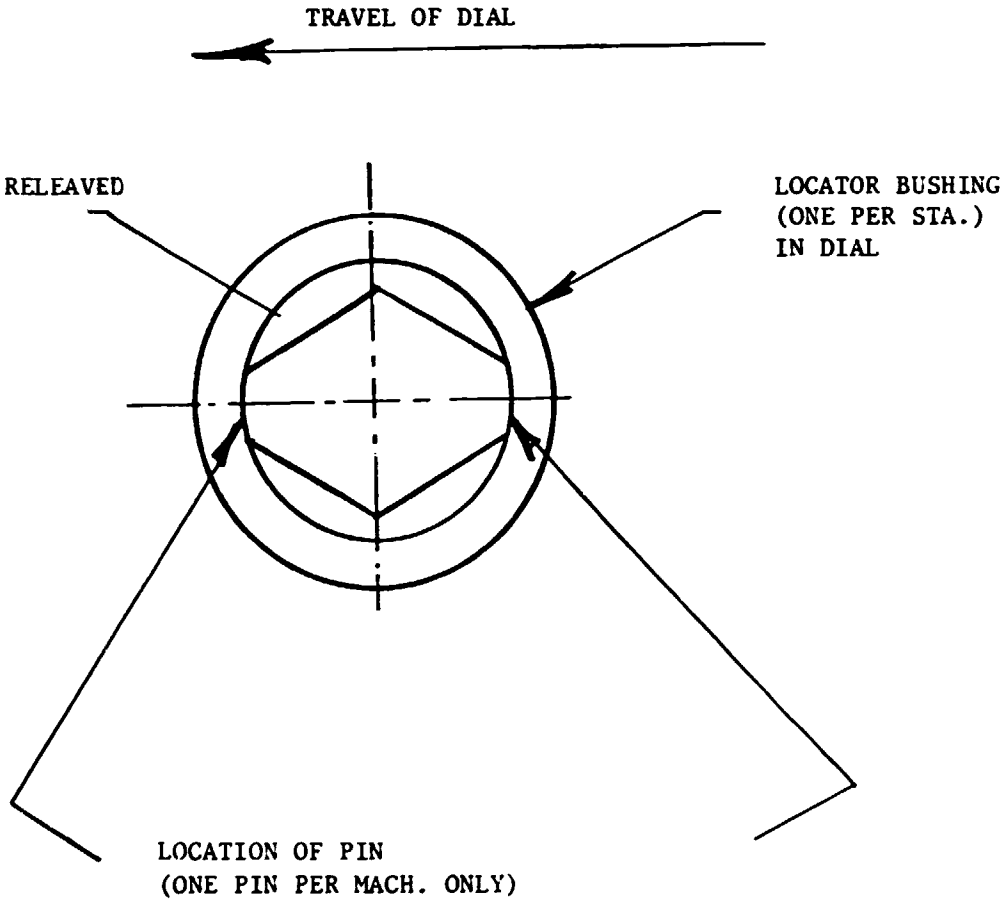
Rapid Adv.	.75	Sec.
Drilling	2.25	Sec.
Return	1.oo	Sec.
Shot Pin Ret.	1.oo	Sec.
Index	2.oo	Sec.
Shot pin Adv.	1.oo	Sec.
Total Cycle Time	8.oo	Sec.

(450 parts per hour with single fixture)

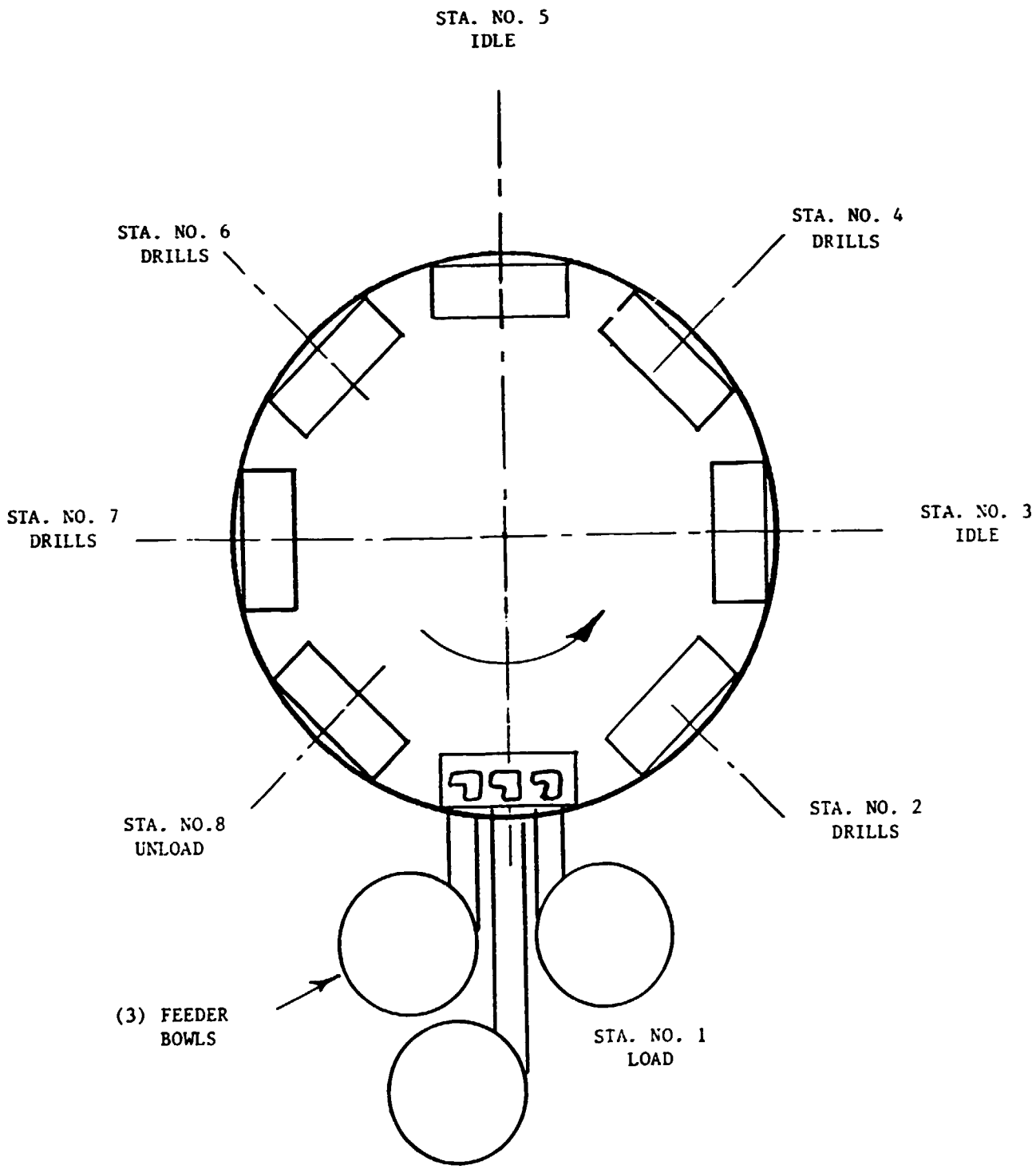
(1,350 parts per hour with tripple fixture)


NEST (HARD)
TRAVEL
OF NEST
ADJ. POSITIVE
LOCATION (HARD)
RECTANGL.
SHOT PIN
SHOT PIN
GUIDE

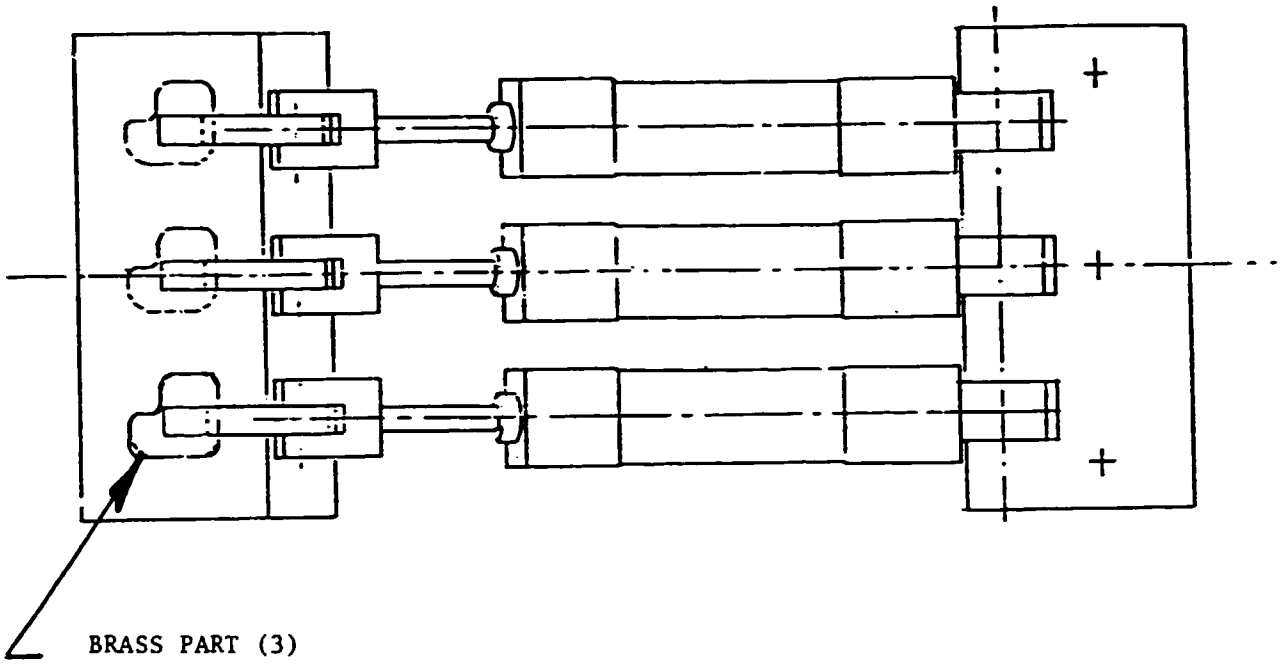
/SKETCH NO. 6/

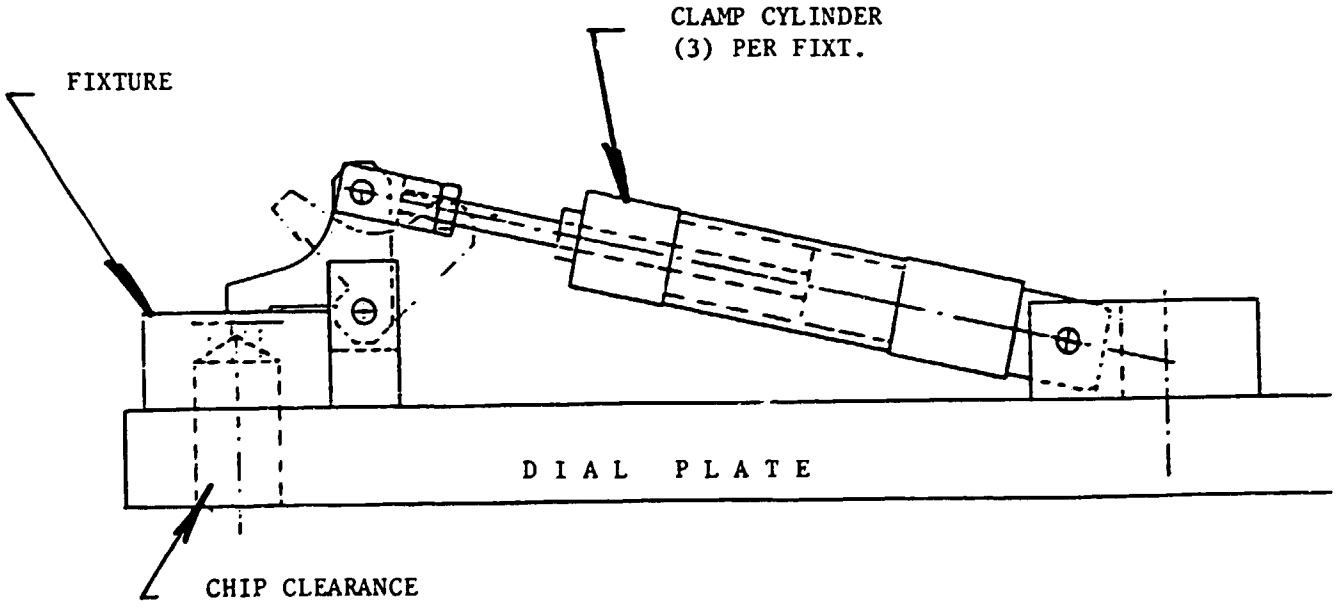

TRAVEL OF DIAL
RELEAVED
LOCATOR BUSHING
(ONE PER STA.)
IN DIAL
LOCATION OF PIN
(ONE PIN PER MACH. ONLY)

/SKETCH NO. 7/


STA. NO. 5
IDLE
STA. NO. 6
DRILLS
STA. NO. 4
DRILLS
STA. NO. 7
DRILLS
STA. NO. 3
IDLE
STA. NO.8
UNLOAD
STA. NO. 2
DRILLS
(3) FEEDER
BOWLS
STA. NO. 1
LOAD

/SKETCH NO. 8/


BRASS PART (3)


CLAMP CYLINDER
(3) PER FIXT.
FIXTURE
DIAL PLATE
CHIP CLEARANCE

/SKETCH NO. 9/

CHANG DAE LTD.

(robotic components)

After arrival at the customer's plant, We met with Mr.I.C. Yang of the R & D Dept. and he presented us with two problems with the standard components of the company.

PROBLEM #1:

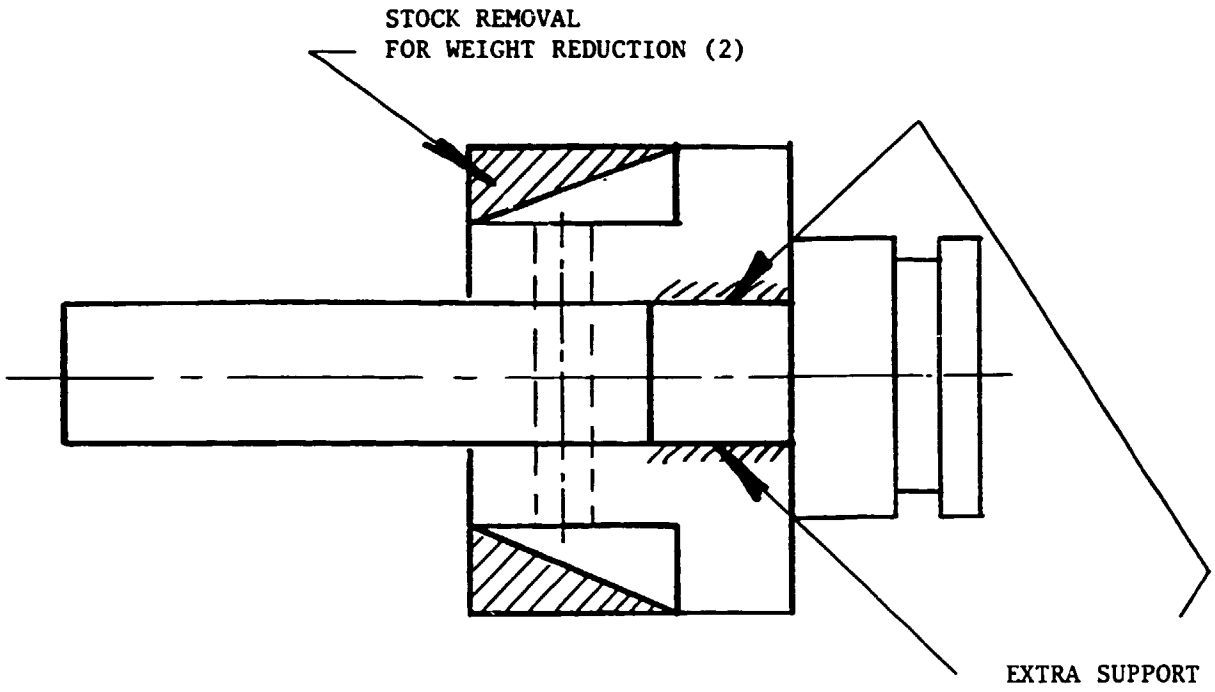
The standard gripper wears fast when mounted in horizontal position. We discussed materials and coating, etc.

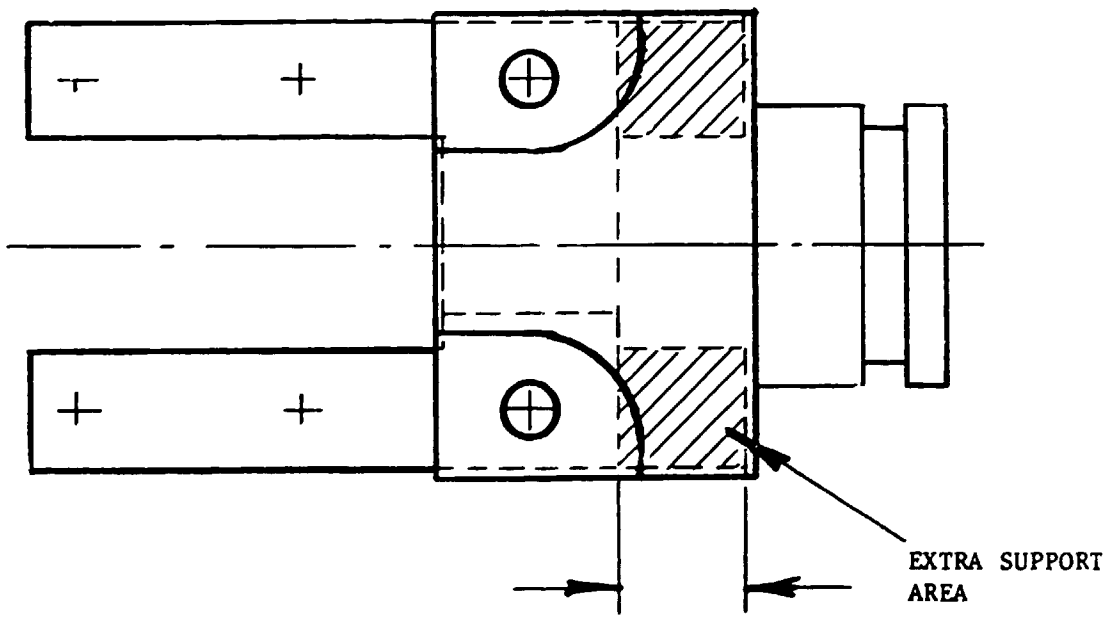
After closer investigation I suggested to mill the slot that accommodates the gripper fingers all the way thru the gripper body and make the fingers longer, giving 2 times the support of the original design, and also removing some stock to cut down on the weight, per Mr. Yang's request.(see sketch #10 on page #22)

PROBLEM #2

On the double rod cylinder (rods side by side) when it is cushioned on the double rod end, the cylinder starts out traveling too slow and at low pressure it does not move at all.

We looked at the crossection drawing of the cylinder and discussed a number of possibilties until one thing lead to another and in a group effort we came to the conclusion that there is a check valve needed to insure free flow to the total piston area of both pistons right in the beginning of the stroke instead of only to the two cushion areas.


STOCK REMOVAL
FOR WEIGHT REDUCTION (2)
EXTRA SUPPORT


EXTRA SUPPORT
AREA

/SKETCH NO. 10/

LIFE ENGINEERING COMPANY

(compressor connecting rod)

We met with Mr. J.M. Baek, Section Chief of Design and Mr. Y.W. Choi, Factory Manager and discussed a (6) station indexing machine, that machines the wrist pin hole and the crank bore and one oil hole of a connecting rod for a refrigerator compressor.

The machine is still in the design stage. I suggested to spreading the machining load over more passes in the crank bore to have less tool pressure and less chance of distortion of the part during machining. I also pointed out that the center distance between the crank bore and wrist pin bore can only be held to specified tolerance if both bores are done in one operation with one head and a common bushing plate.

My suggested sequences of operation is shown on sketch #11 on page #25.

We discussed the work holding fixture design and I told the gentlemen that the basic concept of the design is a good design and that I can only pick a few areas apart to save a little money here and there without reducing the quality of the fixture.

We suggested some areas such as clamping, "vee" block location, chip clearance, etc. see sketch #12 on page#26 for the suggested, less expensive fixture. And see sketch #13 on page #27 for the suggested multi-spindle drill head to insure proper center distances.

There are cast iron and aluminium parts to be machined on this machine. I suggested to use either two speed motors or D.C. variable speed drives to compensate for spindle speed requirements of the two different materials.

I also pointed out the inportance of the lubrication in the multi-spindle head. There has to be an oil level indication , an oil pump and an oil flow indicator. There will have to be angular oil supply holes and oil catching grooves as shown on the sketch #13 on page #27 of the multi-spindle head.

For the gear train I suggested a single train. A sample gear train is shown on sketch #14 on page #28. The pitch of the gears and size or type are optional.

For the tooling holders I suggested a 32mm dia holder for wrist pin and a 40mm dia holder for the crank bore tool. This leaves 1.3mm between the spindles. (see sketch #13 on page #27.

On the second day of our visit, the gentlemen from Life Engineering introduced us to another product they needed some help with. The product was a truck front axel. Our job was to bore the king pin bore and mill clearences with a 365mm dia. cutter.

Because of the size of the part and the 2 minute cycle time I suggested the use of a Trunnion machine. This allows us to work on the first and second pass of the bores on both sides and mill at the same time. After quick calculations, we realized that the milling station requires approximately 90 seconds because the custommer requested feeding into the work as well as feeding out, to insure surface finish and dimensional tolerance requirements.

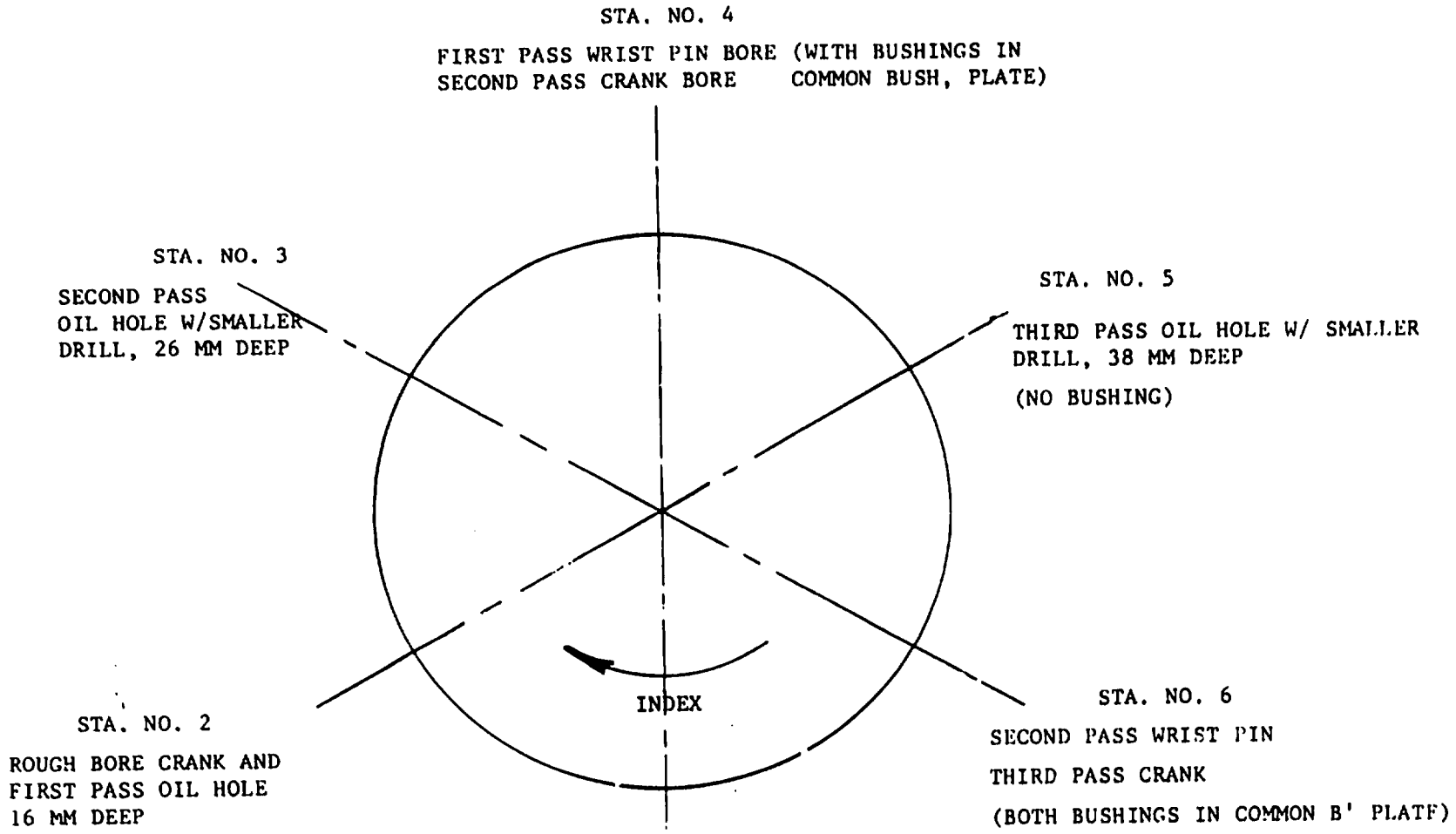
The suggested sequence of operation for this trunnion machine is shown on sketch #15 on page #29.

I pointed out that the use of a trunnion machine will allow the customer to add the drilling and tapping operation of four holes on each side of the front axel in addition to the originally planned operations.

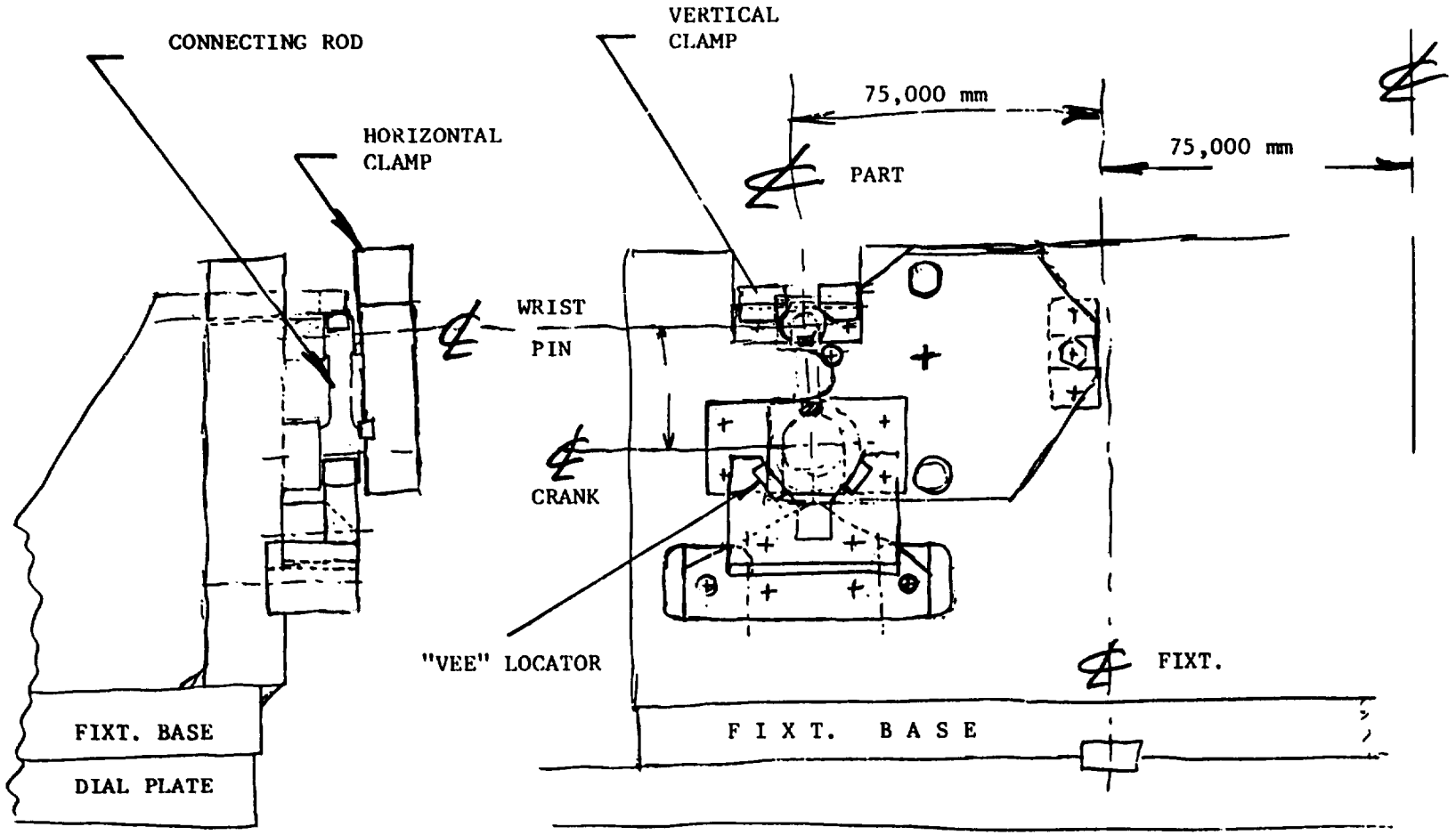
Because of the size of the part, the fixture and consequently the height of the total machine, the operator of this trunnion machine has to work on an elevated platform or the machine has to be installed in a pit.

My first choice would be an elevated platform. (see sketch #15 on page #29)

I suggested using the fixture that was already designed by Life Engineering, but I suggested to increase the clamping forces.

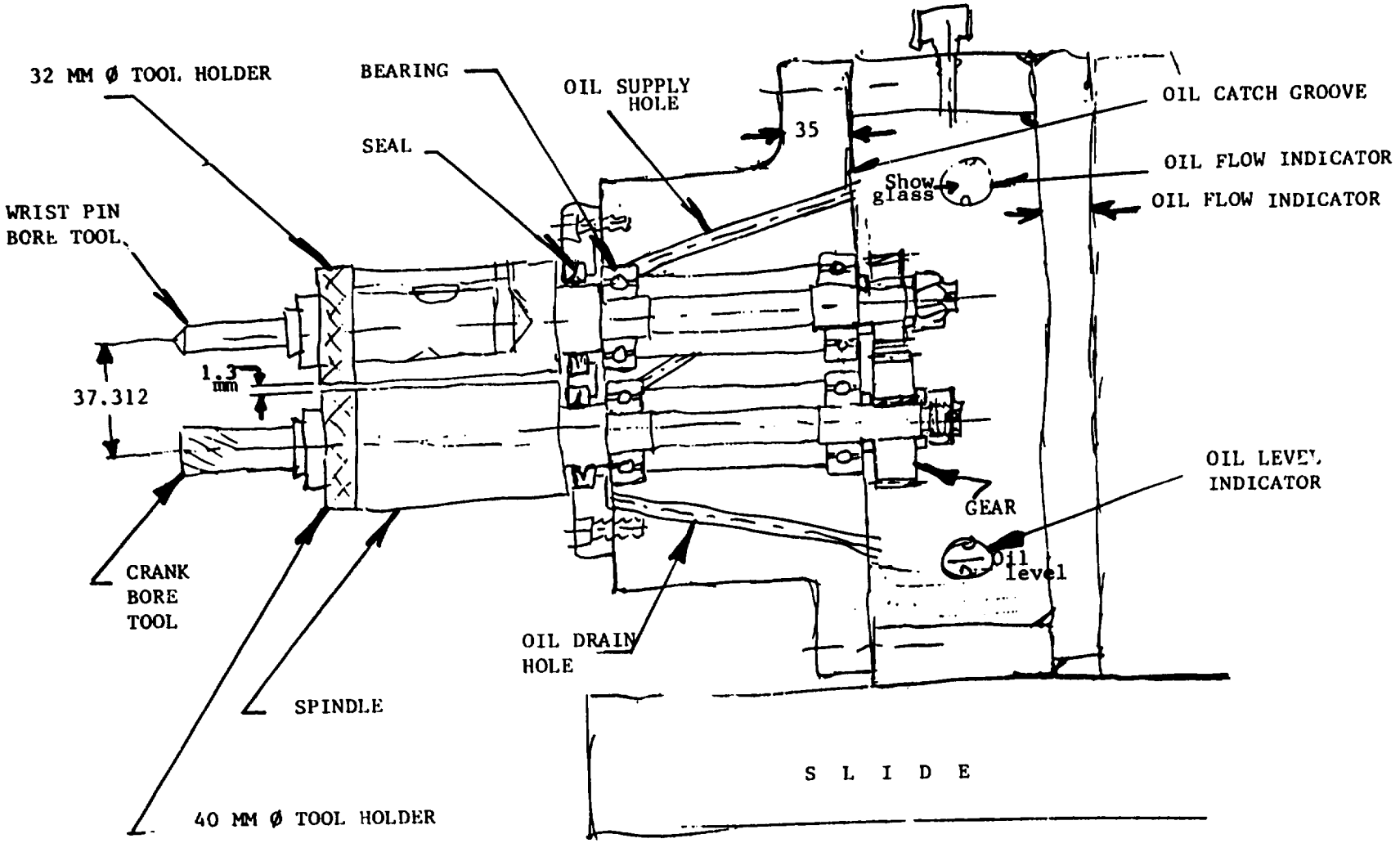

STA. NO. 4
FIRST PASS WRIST PIN BORE (WITH BUSHINGS IN
SECOND PASS CRANK BORE COMMON BUSH, PLATE)
STA. NO. 3
SECOND PASS
OIL HOLE W/SMALLER
DRILL, 26 MM DEEP
STA. NO. 5
THIRD PASS OIL HOLE W/ SMALLER
DRILL, 38 MM DEEP
(NO BUSHING)
INDEX
STA. NO. 2
ROUGH BORE CRANK AND
FIRST PASS OIL HOLE
16 MM DEEP
(BUSHING PLATE)
STA. NO. 6
SECOND PASS WRIST PIN
THIRD PASS CRANK
(BOTH BUSHINGS IN COMMON B' PLATE)
STA. NO. 1
UNLOAD/LOAD (2) PARTS

/SKETCH NO. 11/



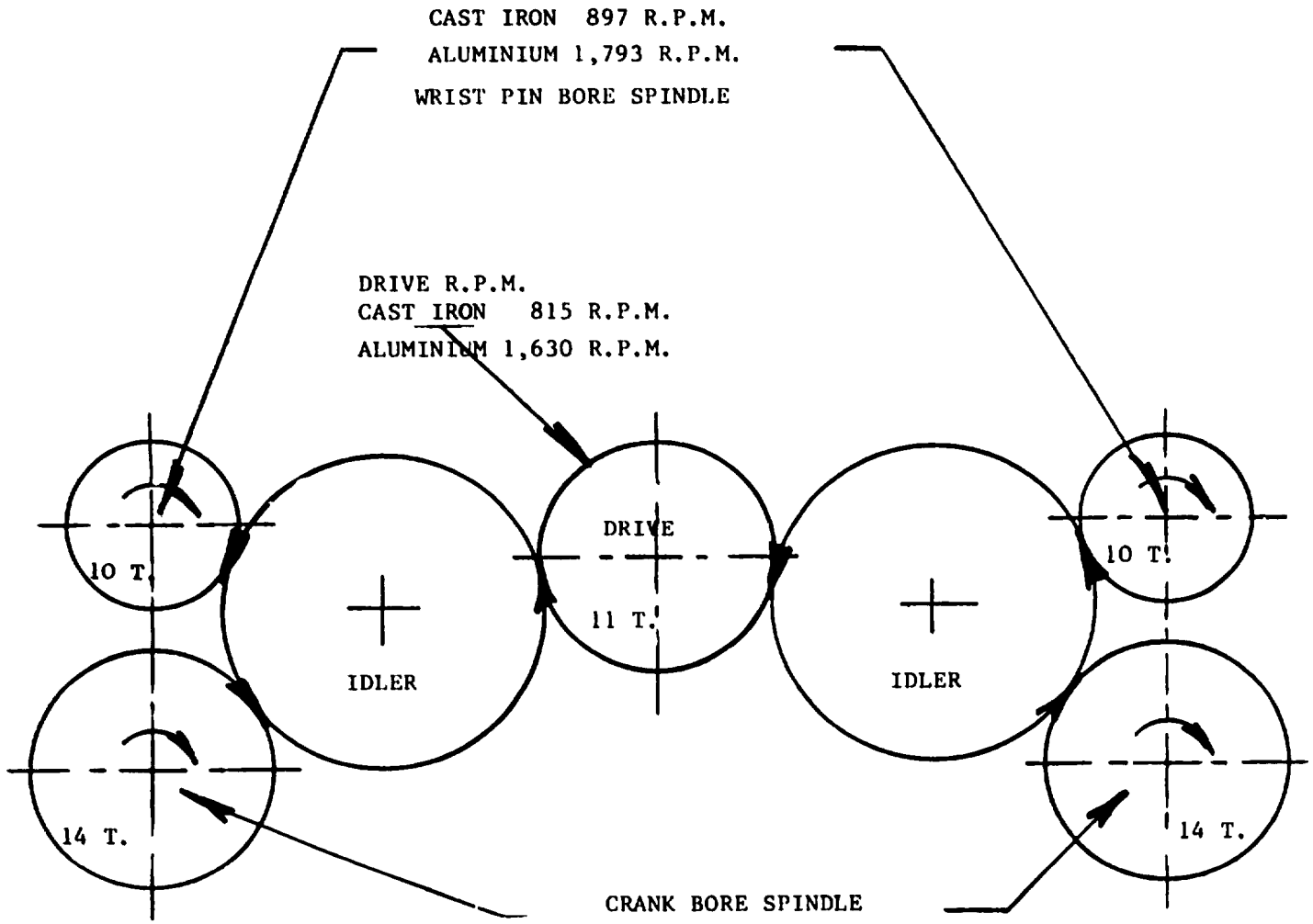
/SKETCH NO. 12/

LIFE ENG. CO. (4-11-89)



/SKETCH NO. 13/

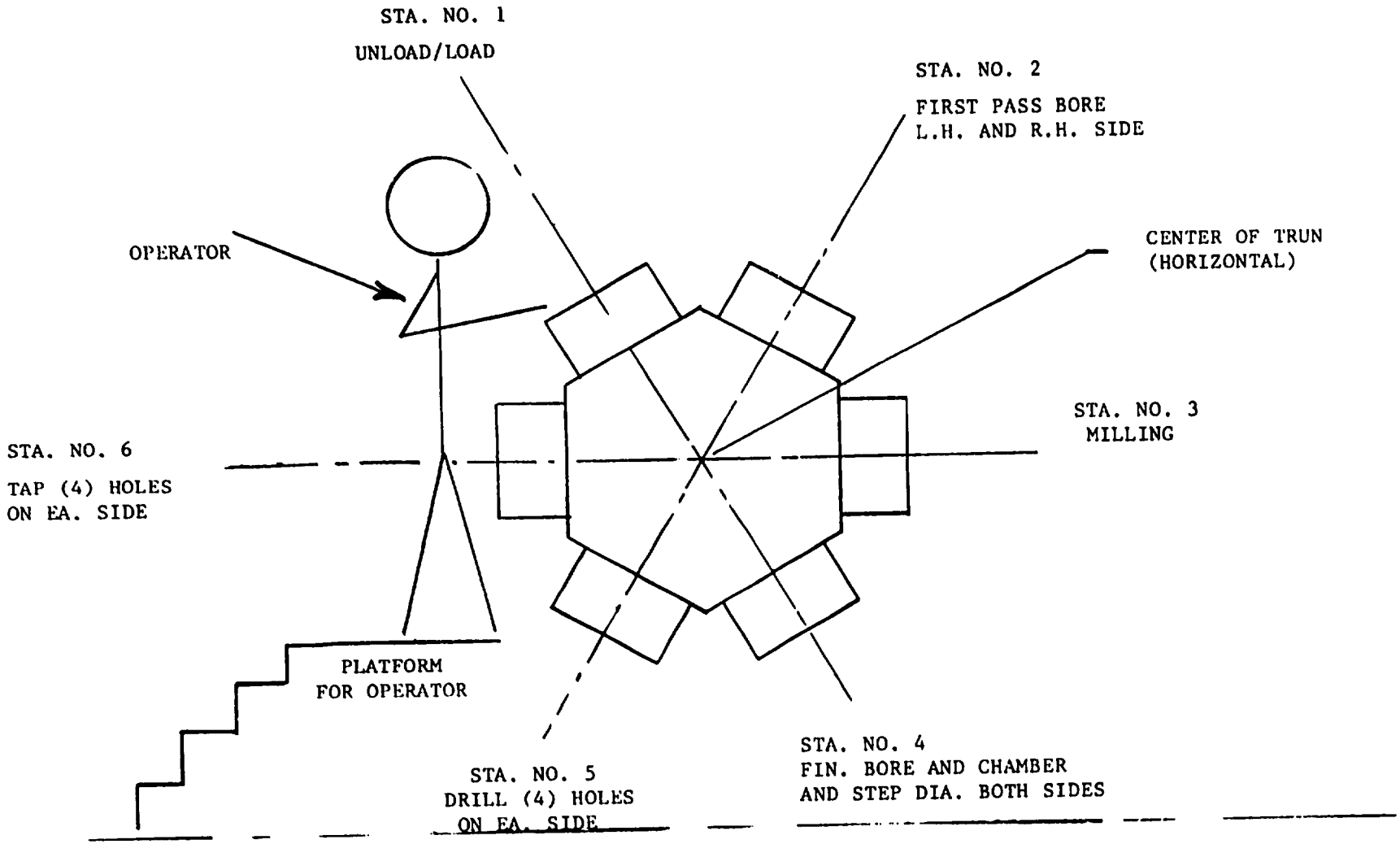
LIFE ENG. CO. (4-11-89)



CAST IRON 640 R.P.M.
ALUMINIUM 1,280 R.P.M.

/SKETCH NO. 14/

LIFE ENG. CO. (4-11-89)



/SKETCH NO. 15/

LIFE ENG. CO. (4-11-89_

SAM JOO MACHINE COMPANY LTD.

(gear shift fork)

After arrival at Sam Joo Machine Co., Mr. Kim and Mr. Lee from S.M.I.P.C. and I met with the Chief Engineer of the Sam Joo Machine Company, Mr. H. H. Kim.

Mister H. H. Kim showed us the manufacturing facilities, and introduced us to the new product, which is a gear shift fork for a standard transmission of an automibile. We were given a reduced drawing of the fork and a similar, actual, part. The material of the new fork was to be cast iron. It is a very flimsy and delicate part to clamp, hold and support during machining.

Our first goal was to concept a work holding fixture that would hold the part in such a way that all machining could be done in one set-up. But after a few hours of design I decided that this was not possible. I suggested to the Chief Engineer, Mr. H. H. Kim, to split the machining operations into two work holding fixtures.

I explained the fixture for the first operation, which was the fixturing for the machining of the bore and the claws.

The second fixture would then locate on the claws and in the newly machined bore.

The clamp was placed in such a way that the rest of the machining could be done.

However, since the machining operations are very concentrated in a small area of the part, it takes three (3) heads to do the job and since cycle time does not allow us to do these operations one after another, I suggested to do these operations on a six (6) station indexing machine, where we can perform all these operations at the same time.

The sequence of operations is shown on sketch #16 on page #32.

The Chief Engineer, Mr. H. H. Kim, was concerned about the accuracy and the repeatability of the indexing machine.

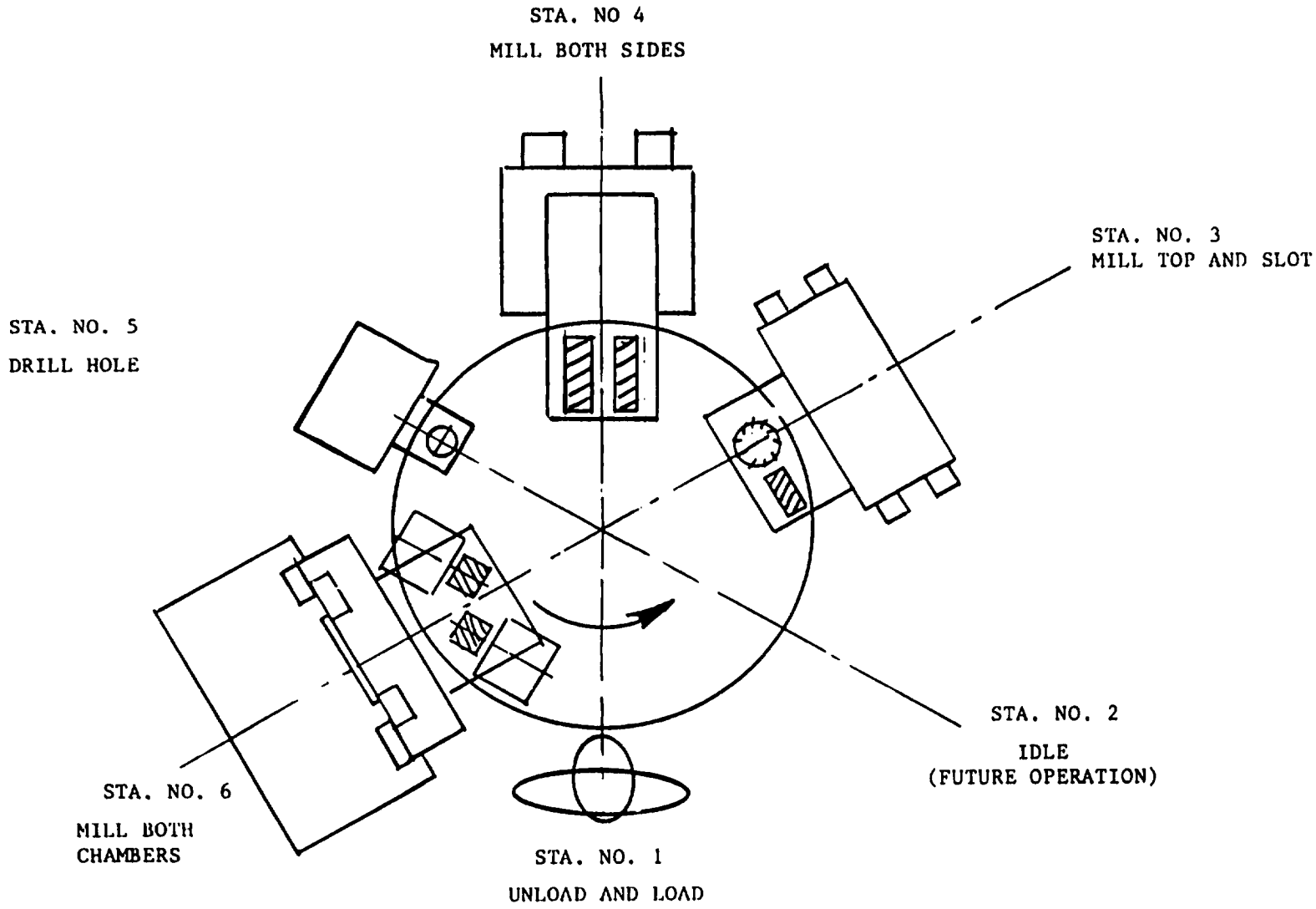
I suggested a rectangular shot pin with the positive side adjustable with fitting spacer. One shot pin for the machine and (6) shot pin nests. (one per station) See sketch #17 on page #33.

I also mentioned that the indexer should stop short of the final position and the shot pin should pull the dial plate into position the last few thousands of an inch. This means that the hardered adjustable positive locator spacer on the rectangular shot pin should be on the trailing end of the nest.
(See sketch #17 on page #33).

Since we had taken care of the projects that were prepaired for us, the Chief Engineer, Mr. H. H. Kim, asked if I would review a few layout drawings of a general assembly and some head designs.

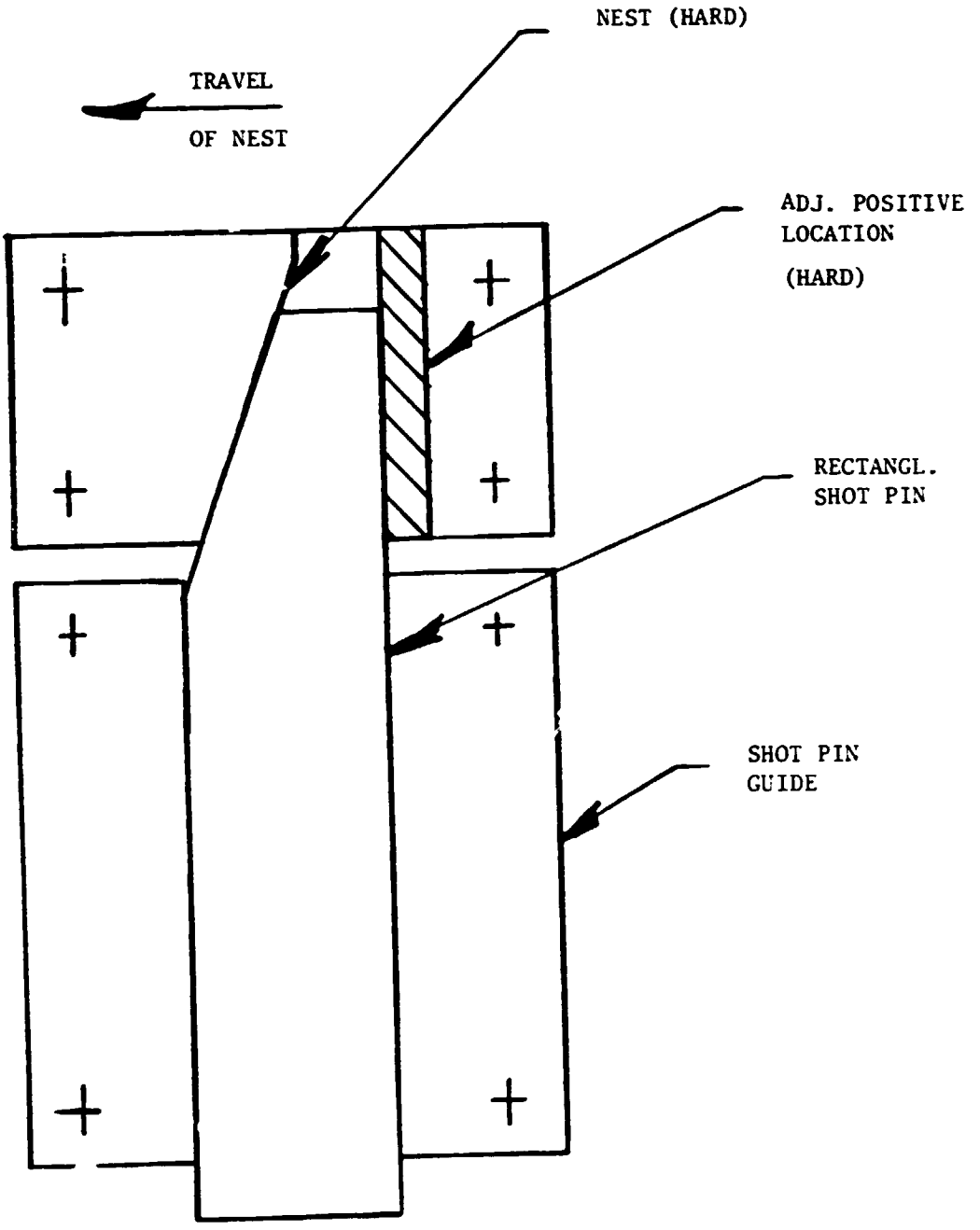
I made a few suggestions on the additional projects during drawing reviews, where Sam Joo Machine Company can save some money and make the designs better at the same time.

Everyone involved seemed to be satisfied with our recommendations.



/SKETCH NO. 16/

SAM JOO (4-13-8)


NEST (HARD)
TRAVEL
OF NEST
ADJ. POSITIVE
LOCATION
(HARD)
RECTANGL.
SHOT PIN
SHOT PIN
GUIDE

/SKETCH NO. 17/

TAE JIN COMPANY

(socket head scew manufacturing)

After arrival at the customers plant we met with Mr. Jae Goo Lee, President of the company and we discussed the material handling of the product which is Hex Socket Screws of various sizes for the automobile industry. I was asked to suggest the best method to transfer the product from one operation to the other. The operations are as follows:

1) Head forging.
2) Knurling head O.D.
3) Thread rolling.

At the present time the plant is organized in the following manner:

All headers are together in one area of the building. After the head forging operation, the screws are put in a box and carried to the knurlers, which are located all together on one end of the building. After the screws are knurled, they are put in a box again and carried to the thread rollers, which are again located all together in one end of the building.

I pointed out that I am not an expert in the manufacture of fasteners but I may be able to help in the material handling portion of the operation.

Therefore my suggestion to the customer was to reposition the machines in such a way that the operations are together for each product with minimum need for any material transportation, keeping in mind raw material handling and storage, maintenance, tool change and safety.

The suggested machine repositioning as shown on sketch #18 on page #36.

Another project was introduced:

The customer has two types of thread rolling machines. One is cam operated and one is hydraulically operated. Both are to be tooled up with an automactic loader. The cam operated one is easily timed with the cam and there is no problem. But the customer is having problems with timing the automatic part loader with the hydraulically operated thread roller.

I sketched up the complete sequence of operation for the cycle (see sketch #19 on page #37) and made the following recommendation:

1) The cylinder has to have a signal indicator or monitor on each end of the stroke so that the automatic loader will stay in correct timing with the cylinder operated die.

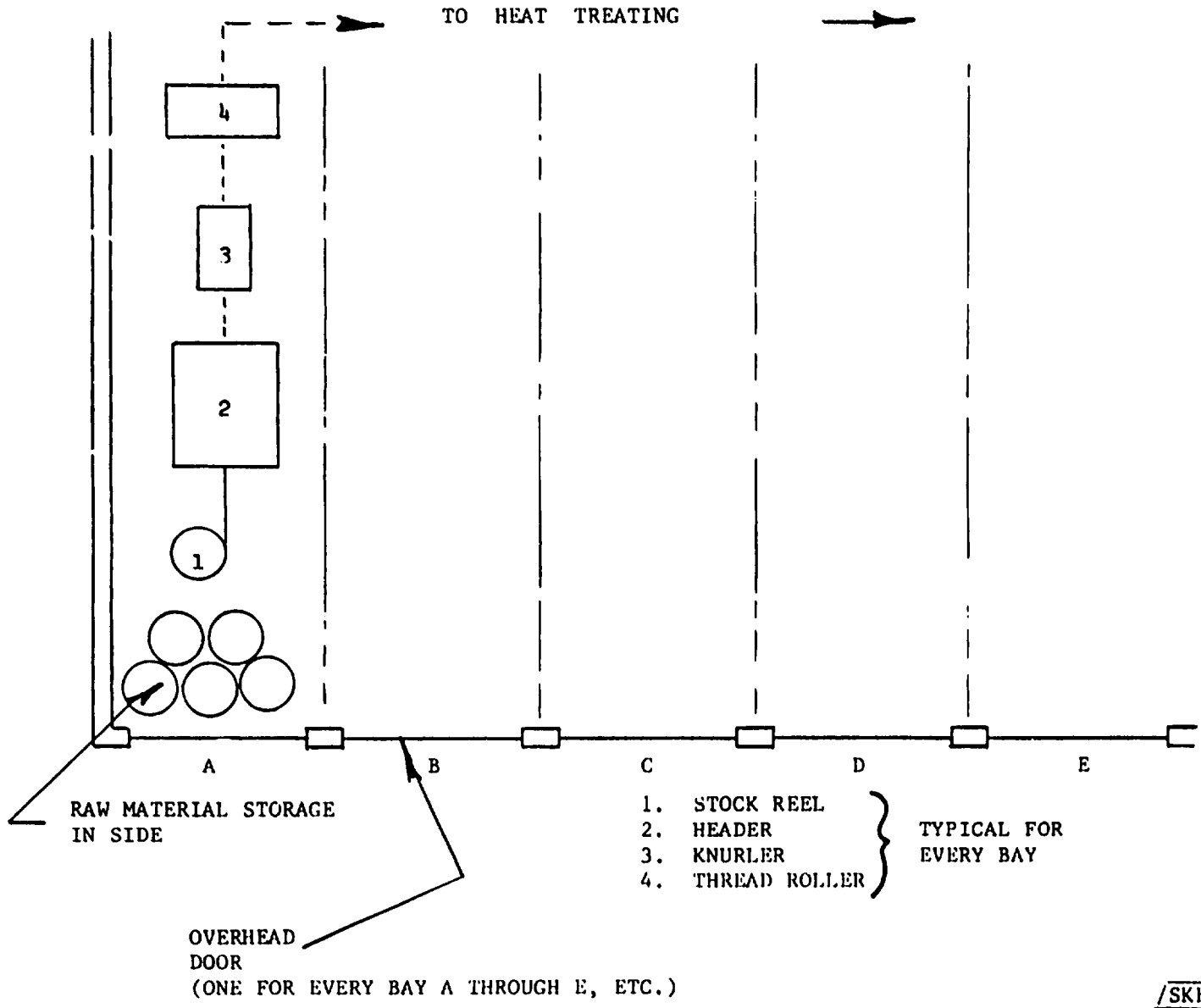
Or:

2) The automatic loader can be cam operated and give a start signal to the cylinder to operate and when the cylinder has completed its cycle, it has to give a start signal to the automatic loader.

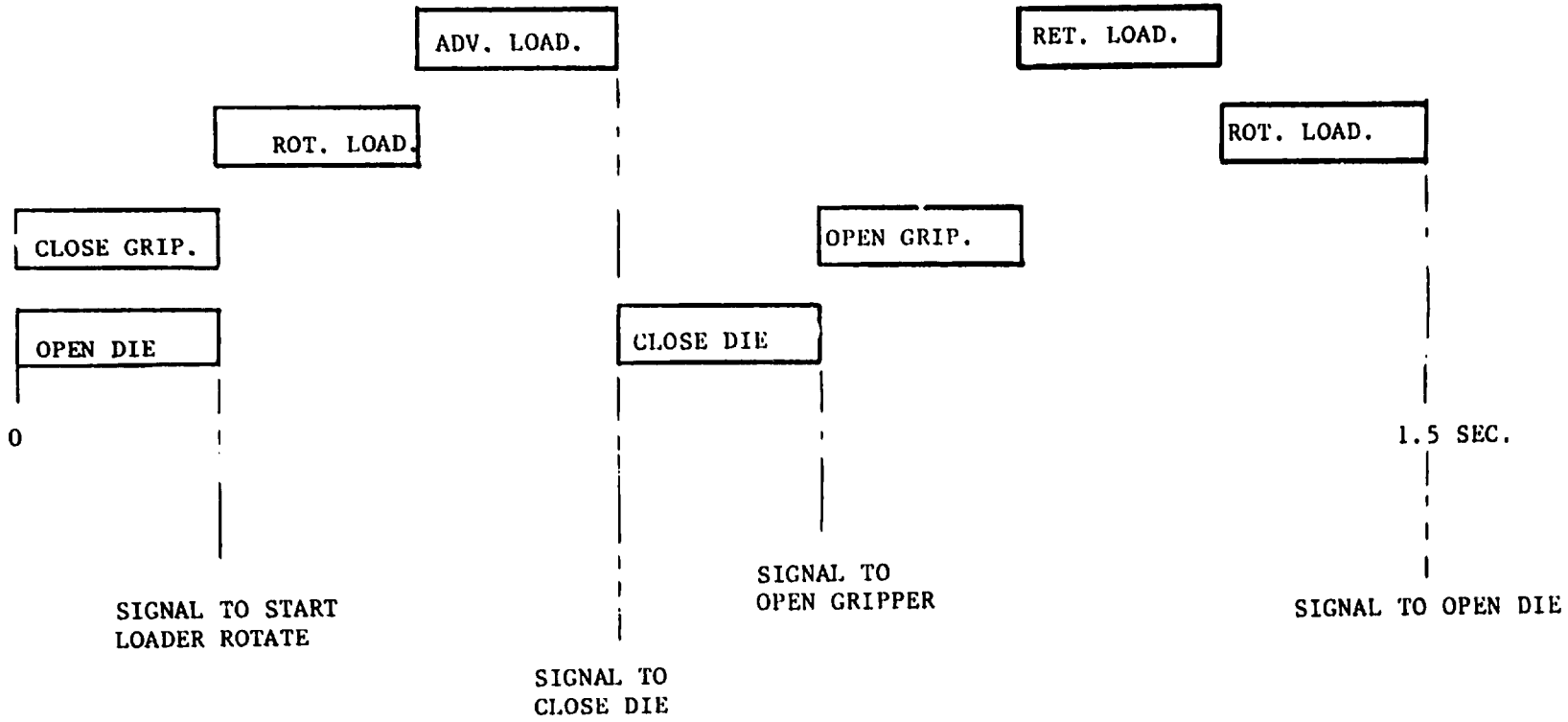
With this method, the loader has to stop after each cycle to insure the completion of the cylinder cycle.

This start and stop cycle would have to be done with a clutch / brake unit, keeping the motor running all the time.

I also suggested to present the parts to the loader via a gravity track with the axis of the part horizonal so that the rotating motion of the loader can be eliminated from the cycle. (This saves time and motion).


TO HEAT TREATING
4
3
2
1
A
B
C
D
E
RAW MATERIAL STORAGE
IN SIDE
1. STOCK REEL
2. HEADER
3. KNURLER
4. THREAD ROLLER
TYPICAL FOR
EVERY BAY
OVERHEAD
DOOR
(ONE FOR EVERY BAY A THROUGH E, ETC.)

/SKETCH NO. 18/


ADV. LOAD.
RET. LOAD.
ROT. LOAD.
ROT. LOAD.
CLOSE GRIP.
OPEN GRIP.
OPEN DIE
CLOSE DIE
0
1.5 SEC.
SIGNAL TO START
LOADER ROTATE
SIGNAL TO
CLOSE DIE
SIGNAL TO
OPEN GRIPPER
SIGNAL TO OPEN DIE

/SKETCH NO. 9/