



TOGETHER
for a sustainable future

OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.



TOGETHER
for a sustainable future

DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

RESTRICTED

17851

DP/ID/SER.A/1278
15 November 1989
ORIGINAL: ENGLISH

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

* This document has not been edited.

14/5

V.89-61282

TABLE OF CONTENTS

A. ITINERARY

B. INTRODUCTION

Briefing.

Mission.

De-briefing & Follow-up.

C. Activity

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

Royal Metal Co. Page # 7 thru # 12

Jin Sung Precision Page # 13 thru # 18

A. ITINERARY

Date	Day	Work Class	Name of Company	Location	Contents
9-17	Sun.	Arrive		Seoul	P. M.
9-18	Mon.	Meeting	UNDP, SMIPC	Seoul	Report to UNDP Discuss Problem areas, Introduction
9-19	Tue.	Visit	Royal Metal Ind.	Bucheon	Nail Clippers
9-20	Wed.	Design	Royal Metal Ind.	Bucheon	Nail Clippers
9-21	Thu.	Design	Royal Metal Ind.	Bucheon	Nail Clippers
9-22	Fri.	Design	Royal Metal Ind.	Bucheon	Nail Clippers
9-23	Sat.	Other	S.M.I.P.C.	Seoul	Summerize Visits, Study, Design, etc.
9-24	Sun.	Rest		Seoul	
9-25	Mon.	Design	Royal Metal Ind.	Bucheon	Nail Clippers
9-26	Tue.	Design	Royal Metal Ind.	Bucheon	Nail Clippers
9-27	Wed.	Design	Royal Metal Ind.	Bucheon	Nail Clippers
9-28	Thu.	Design	Royal Metal Ind.	Bucheon	Nail Clippers
9-29	Fri.	Design	Royal Metal Ind.	Bucheon	Nail Clippers
9-30	Sat.	Other	S.M.I.P.C.	Seoul	Summerize Visits, Study, Design, etc.
10-1	Sun.	Rest		Seoul	
10-2	Mon.	Holiday		Seoul	Preliminary report
10-3	Tue	Holiday		Seoul	Preliminary report
10-4	Wed.	Visit	Royal Metal Ind.	Bucheon	Present designs and discussed operations
10-5	Thu.	Visit	Jin Sung Precision	Kimpo	Asia Jeep seat frame
10-6	Fri.	Visit	Jin Sung Precision	Kimpo	Motor cycle brake adjustment screw
10-7	Sat.	Depart		Seoul	Report and Depart

B. INTRODUCTION

Briefing.

The mission began on Monday September 18th 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 few months since my last visit in April.

Since this was my sixth 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. Since we have worked together before that made our team work even more efficient.

Professor Geon Cha Kim of S.M.I.P.C. presented me with the schedule that was intended for my stay in Korea.

We reviewed the Royal Metal Project (Finger Nail Clippers) from my last trip in April 1989.

Mr. Kim told me that the Royal Metal Co. wants to expand on the already established project design from my last trip. Royal Metal Co. wants to add three operations to the previously conceived Rotary Grinding Machine.

We discussed the project and the feasibility of adding the three operations to the original concept.

In the afternoon we went to the U.N.D.P. office to present our schedule to Mr. P.C. Park.

Another specialist in the grinding field (Mr. Norman Armstrong) joined us on the way over to the U.N.D.P. office.

At the U.N.D.P. office, Professor Geon Cha Kim of S.M.I.P.C. presented Mr. P.C. Park with our schedule and discussed the projects for a little while.

Mr. Park then walked us over to Mister Guijt's office and introduced us to Mr. Jacob Guijt, Resident Representative for U.N.D.P. in Seoul.

Mister Guijt has a very pleasant personality and has traveled to several parts of the world. He is a born ambassador and I can see already that with his help U.N.D.P. in Seoul will be an even more successful organization than it already is.

Mr. Park expressed, as he did in the past, that several companies of small and medium size are in great need for service of experts in the field of automation.

Mister Guijt and Mister Park were very interested in our project at Royal Metal CO. and we sheduled a visit to the Royal Metal Company so that Mister Guijt and Mister Park can get a first hand look at our efforts in the field.

After we returned to Mr. Parks office, we were informed by the Pay Master's Office that there was no authorization for payment for my living allowance received by the U.N.D.P. office in Seoul. Therefore I was not able to receive any check for living expenses. Mr. Park told us that he requested an authorization about two weeks ago but has not received a response from U.N.I.D.O. in Austria.

Mr. P. C. Park assured me that he would fax another request for authorization to Austria on 10-18-89. I asked what I was to do for living expenses and he replied that he is very sorry but the Paymaster's Office at U.N.D.P. in Seoul can not issue a check without authorization from U.N.I.D.O. in Austria.

Mission

The actual working session began on Monday September 19th after I returned to S.M.I.P.C. from U.N.D.P. and ended on Saturday October 7th covering a period of three weeks with visits to two companies, addressing several problems during each visit, spanning a variety of different applications.

During this period I was working with Professor G. C. Kim, who was my translators and partners during my entire stay in Korea. Mister G. C. Kim is a pleasure to work with. He is a true asset to S.M.I.P.C..

Every time I come back to Korea I can notice a little progress in the Automation Department under the leading direction of Mister Nam.

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

I have enjoyed meeting with Mister Guijt, Mister Park and the team work with Professor G. C. Kim. And would be honored to serve U.N.D.P. and 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.

Professor G. C. Kim expressed to Mister Park that he would like to have me return to Korea as soon as possible to work on the continuation of the Royal Metal Project and additional projects in other companies.

I replied that I may be able to return in April of 1990 and I would let U.N.I.D.O. know as soon as I can finalize my office work schedule for the first part of 1990.

Debriefing and follow-up

Before leaving Korea, I had a short meeting with Mister P. C. Park at U.N.D.P. in Seoul. We discussed some of the projects and the recommendations. I reported to Mister Park that the Royal Metal Project is shaping up nicely and that Royal Metal will be able to start manufacturing all fixture components to the detail drawings I have drawn during this trip. However the drawings should be checked for dimensional accuracy before starting manufacturing.

Professor G. C. Kim asked me to gather several catalogs of purchased components of several companies that are needed for some of the projects we were working on and forward these catalogs to Professor G. C. Kim in Korea.

From Korea I traveled to Vienna in Austria.

There I met with Mister Prijapratama. I briefly reported about my stay in Korea. I reported about several projects that I have worked on in the past through S.M.I.P.C.. I mentioned that my assistance is requested in Korea as soon as possible but it is difficult some times to leave the office for any length of time if you run your own business as I do.

Mister Prijapratama and I discussed that I may be able to travel to Korea during April of 1990 but I have to wait with an exact travel schedule until I have completed my office work schedule for next spring. I will let S.M.I.P.C. and U.N.I.D.O. know as soon as possible.

I also mentioned that I have had very slow response by Fax from U.N.I.D.O. and some times I also have to spend a lot of time trying to send a Fax to U.N.I.D.O.. Mister Prijapratama explained to me that the Fax Machine is shared with several organizations and that it some times truly effects the efficiency of his department also. I suggested that there should be at least one Fax Machine on each floor of the Building.

Mrs. Phantakul gave me a little back ground on the procedures of the reimbursements of expenses and she gave me a few (F.10) Vouchers for Reimbursement of Expenses.

Mrs. Zeilmayer gave me a little back ground on the history of U.N.I.D.O. and explained the layout and the structure of the departments, offices and the organization as a whole.

Mrs. Sahraoui had me sign the original contract of the "SPECIAL SERVICE AGREEMENT EXPERT ON MISSION" because there was not enough time available between the preparation of the contract and my departure date.

The over all debriefing in Vienna was very pleasant and all people I dealt with were very nice and professional. I think it would have been beneficial if I had stopped in Vienna for briefing before my first trip for U.N.I.D.O. in April of 1989. That would have helped me with the construction of my first report.

I was impressed how nicely people from so many nations can work together in one organization and communicate with each other in english, which is the second language for most of the people I met. Most of them grew up with another language. When I went through the building to the different people I had to see I was thinking how wonderful it would be if countries could live in peace and harmony just like the people at the United Nations work together.

After my return from Vienna, I reported back to Mister J.B. Park by fax and informed him that my tentative plan to return to Korea was in April of 1990 and that my Visa will expire before that. Mister Park called me back on the phone and wellcomed me back to the U.S.A.. We discussed some of my activities in Korea briefly and he assured me that there may not be a problem getting a new Visa for Korea next Spring.

C. ACTIVITY

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

ROYAL METAL COMPANY

(Production of Nail Clippers)

Prof. Geon Cha Kim and I went to see the Royal Metal Industrial Company. We met with Mr. G. S. Kim, Production Manager, who explained the additional operations to us that were to be added to the original project as it was conceived.

Originally the fingernail clipper grinding machine was conceived so that the clipper was to be put into a fixture on a slowly rotating dial plate. The operations were:

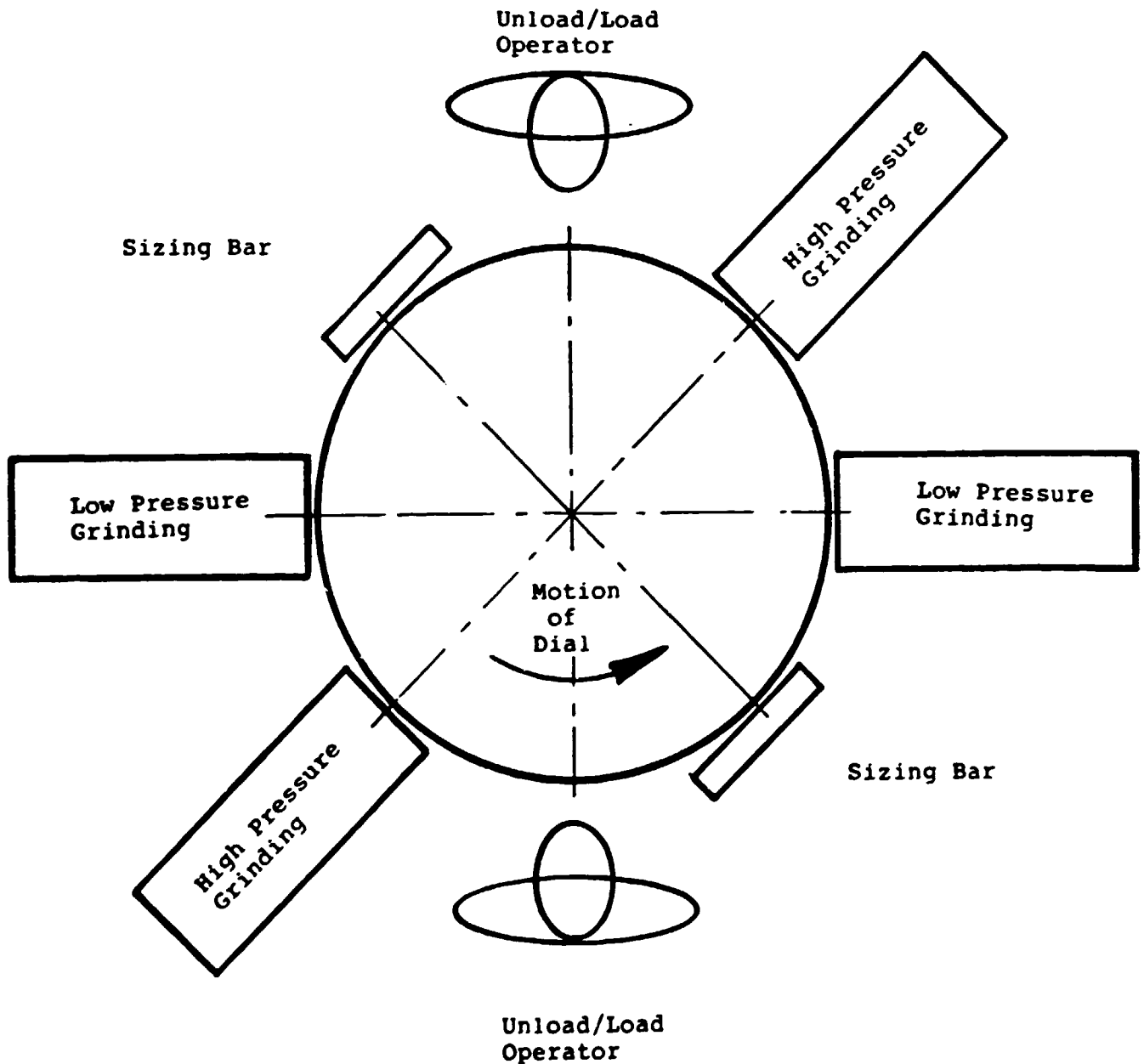
- 1) Load & clamp
- 2) Positioning with a sizing bar and fixture secured to dial plate
- 3) Low pressure applied to clipper arm and grinding of cutting edge
- 4) High pressure applied to clipper arm and finish grinding of cutting edge
- 5) Unclamp and unload of clipper

The additional operations that the Royal Metal Co. wants to add to the machine are:

- 6) Riveting of Pivot Pin
- 7) Repositioning of opener 90°
- 8) Disengaging clipper lever from grinding pressure arm nest and moving clipper arm 180° around the axis of the Rivet.

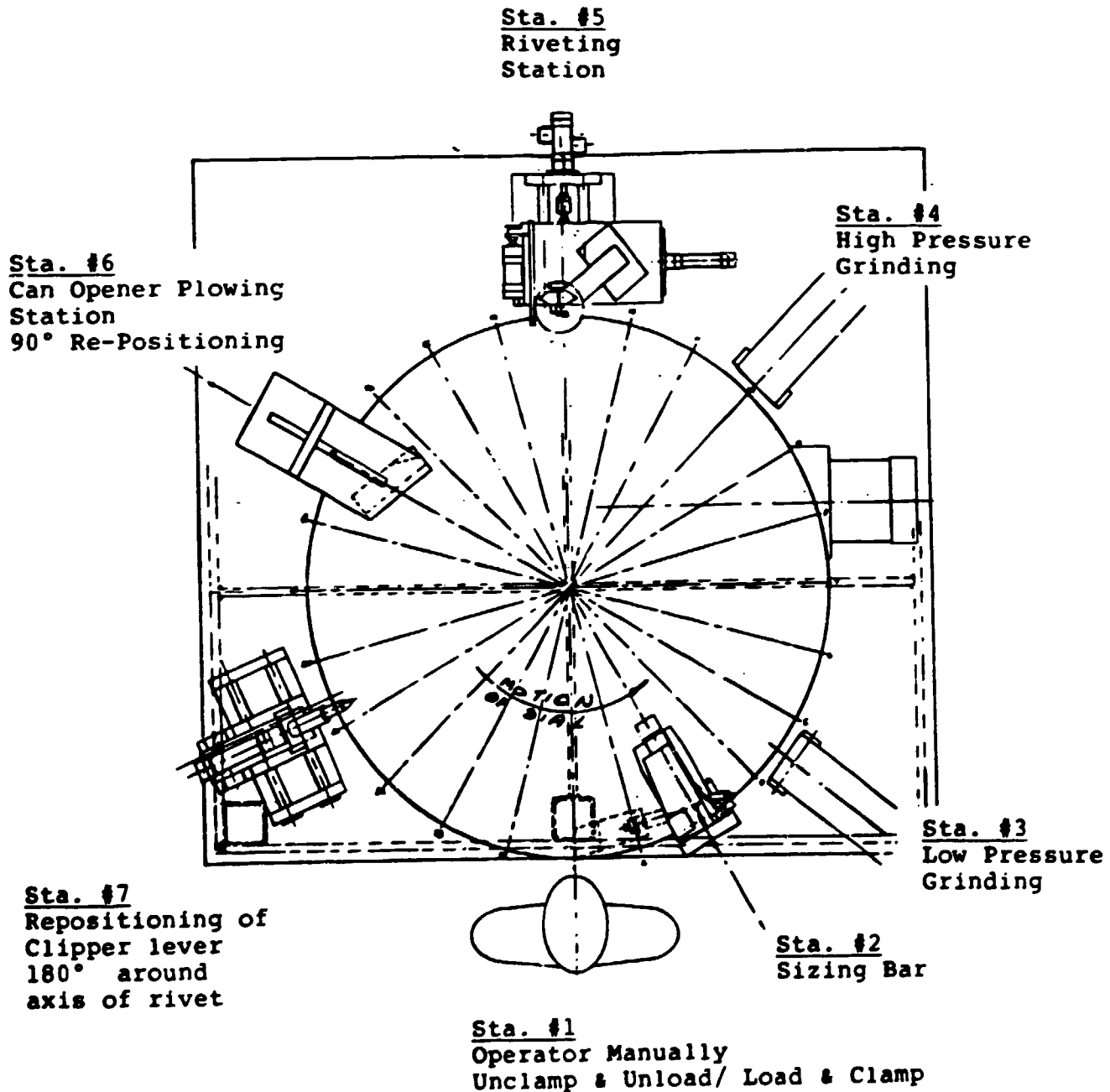
The additional operations require that the original fixture design is to change slightly.

The originally proposed machine concept was to be operated by two or three operators and only doing the above operations #1 thru #5 of grinding. See sketch #1 on this page below



SKETCH 1

The customer (Royal Metal) feels that the machine would be more efficient and easier justifiable if the additional operations were performed on this same machine. Making the total machine look as shown on sketch #2 on this page below: Note! this sketch #2 is a reduction of the actual assembly drawing.



SKETCH 2

The station description of the new operations as shown on sketch #2 are as follows:

Sta. #5 Riveting Station

As the fixture nears the station, an engagement will be activated to engage with a driver dog. Now the station's airspring slide will be slaved of the dial plate, insuring synchronized speed. As soon as the station moves with the dial, we will receive a signal from the slide airspring to advance the riveting head to the working position. An anvil will enter a nest on the fixture below the rivet. When the riveting head has reached the forward position we will receive a signal to start the riveting tool for approx. .3 seconds. At the end of the riveting cycle, the riveting head will withdraw out of the nest and the airspring will return the airspring slide to its home position, ready for the next cycle.

Sta. #6 Re-positioning of Opener 90°

This station consists of a plow that is mounted on a stationary bracket that will engage the can opener portion of the fingernail clipper as it moves past the station. This action will position the opener vertically so it can be chrome plated at one of the next operations of the total process of the product. We are not involved with the chrome plating process at this point.

Sta. #7 Re-positioning of clipper lever 180° rotation around the axis of the rivet

As the fixture nears the station, an engagement will be activated to engage with a driver dog. Now the airspring slide will be slaved of the dial plate, insuring synchronized speed. As soon as the station moves with the dial, we will receive a signal from the slide airspring to advance the tooling arbor.

The tooling is mounted on front of the arbor. First the round portion of the tooling will contact the clipper lever, disengage the lever from a nest and rotating the lever 30° around a horizontal axis, placing it into a parallel position behind a hook tool, which will rotate the lever 180° around the axis of the rivet during the return stroke of the tooling arbor.

At the return position of the tooling arbor we will receive a signal that will disengage the driver dog, which will cause the airspring slide to return to its home position, ready for the next cycle.

With this new method of one operator unloading and loading and the additional operations, I estimate the production rate to be approx. 2 sec. cycle, which brings the total production to approx. 14,400 parts for each 8 hour shift at a 100% efficiency calculations.

There was a meeting scheduled for Mr. Jacob Guijt, U.N.D.P. Resident Representative, Mr. Pyong Chol Park, U.N.D.P. Program Officer to visit the factory at Royal Metal on Wednesday Sept. 27, 1989.

Prof. Geon Cha Kim and I went from the S.M.I.P.C. office to meet with Mr. Guijt and Mr. Park at the U.N.D.P. office and jointly with two cars followed each other to the Royal Metal Manufacturing Plant.

There we were met by Mr. Gap Su Kim, the Production Manager and the Vice President of the company. Manager Kim gave us a presentation of the company's history followed by the tour thru the factory. I updated everyone on the latest engineering development of the project and everyone seemed quite satisfied after the meeting.

Wednesday, Oct. 4th 1989 was the last day scheduled for the Royal Metal Project.

I gave a progress report on the Royal Metal Project as follows:

- A) The general assembly is concepted and consists of two sheets at this time.
- B) Sta. #5 Riveting, Sta. #6 Can Opener Plow, and Sta. #7 positioning of lever are all concepted and consist of one sheet each.
- C) The fixture assembly, which was concepted on my trip in April of 1989 is now completed. The parts list of manufactured parts, showing part numbers, quantities and part names is on the main fixture assembly drawing sheet #1.
- D) All 21 fixture details are drawn complete with dimensions and material and heat treat call out. However, I have placed a note on each detail drawing sheet that reads as follows:

"NOTE! All detail drawings have to be checked for dimensional accuracy and signed by the checker before manufacturing."

I pointed out that important note to Prof. G.C.Kim. And I also asked him to relay the message to the customer that it is especially critical on this project because there will be twenty four (24) fixtures on this machine and that means every little possibility of a mistake will be multiplied by 24.

I have also made a detail drawing of the dial plate. This drawing still needs some dimensions for the mounting of an overload clutch, which I strongly recommend to protect the machine from self-destruction during automatic operation. This overload clutch will disengage when for some reason a station or other item engages the dial plate while the machine is running and when there should not be an engagement.

There are also airsupply ports etc. to be added when the information becomes available.

The following engineering work still has to be done before the project can be called complete:

- A) Checking of all fixture drawings
- B) Completion of airsupply and manifold on the general assembly. And the detail there of.
- C) Design, detail and checking of the sizing bar.
- D) Modification and mounting of the grinding station to the main machine.
- E) Design, detail and checking of station #5 (riveting)
- F) Design, detail and checking of station #6 (plowing)
- G) Design, detail and checking of station #7 (lever positioning)
- H) The controls for all the above.

JIN SUNG PRECISION INDUSTRIAL CO.

(Production of Asia Jeep Seat Frames)

(Production of Motor Cycle Brake Adjustment Screw)

Professor Geon Cha Kim of S.M.I.P.C. and I went to the Jin Sung Precision Industrial Company and met with Mr. Kim, Jin-Hak, President of the company and with Mr. Kim, Won Bin, Director.

Two of the products were introduced.

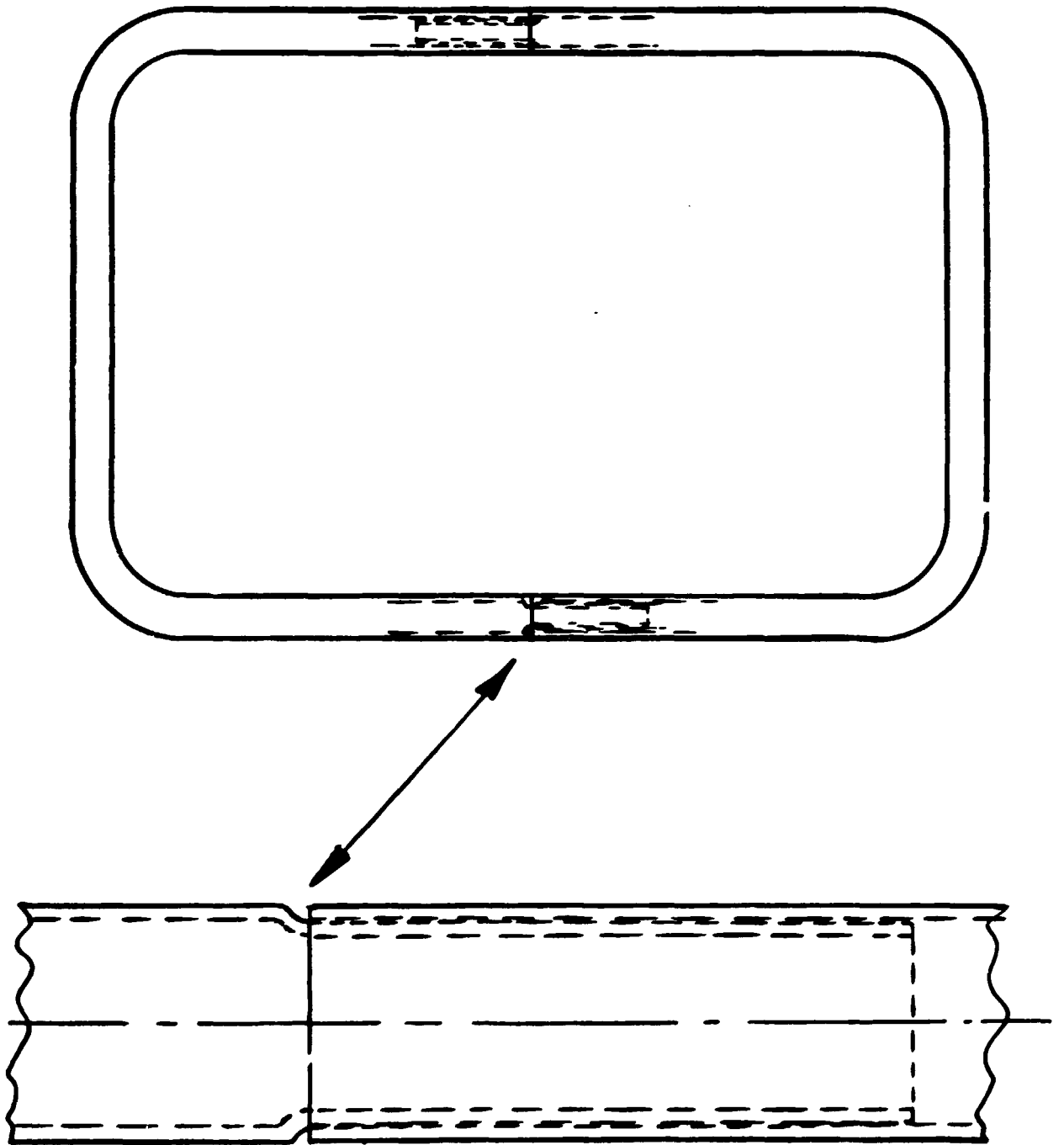
- 1) The tubular frame of the new "Asia" Jeep seats.
- 2) The center hole drilling of the brake cable adjustment for motor cycles.

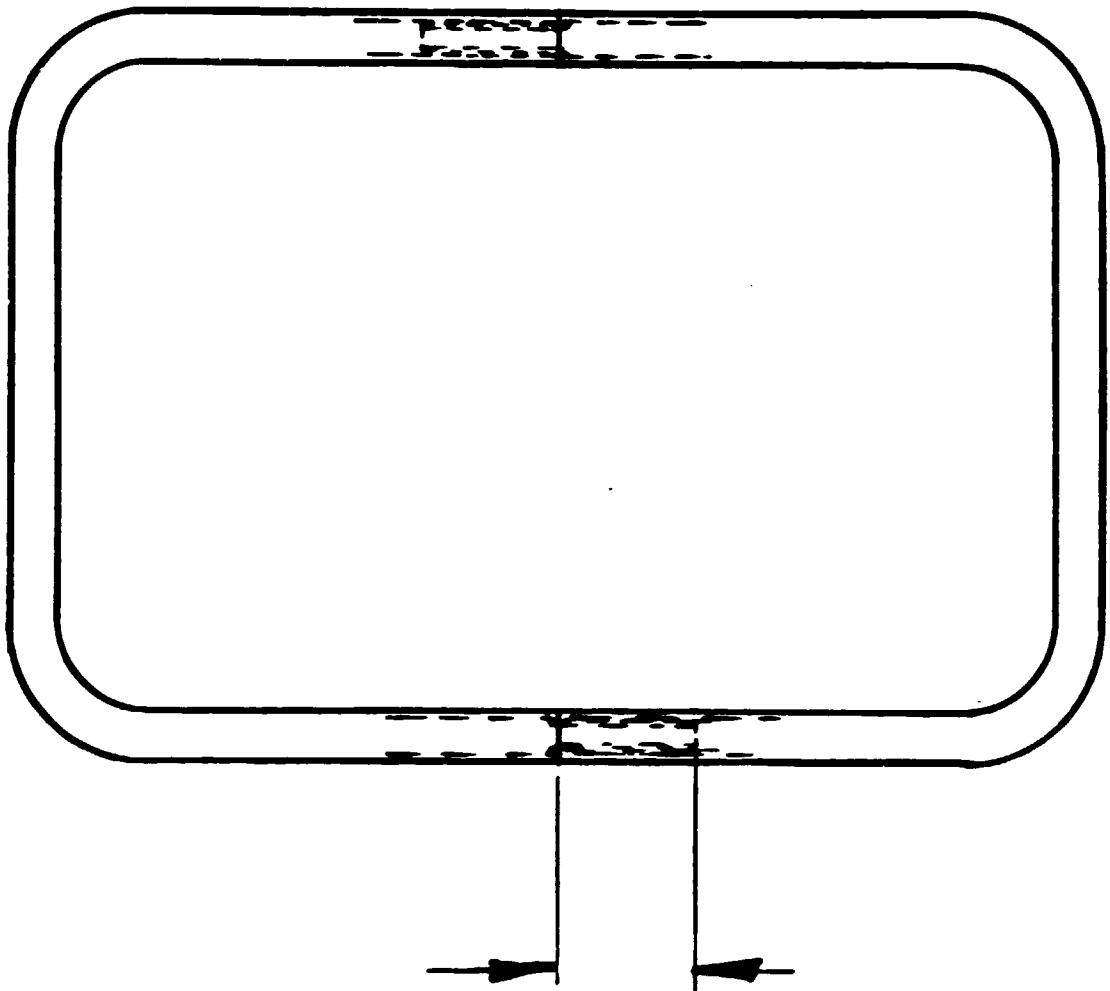
Project #1 (Tube frame for Asia Jeep seat)

We toured the manufacturing facilities and looked at the present production method of tube frame for seats. The existing frame consists of two parts.

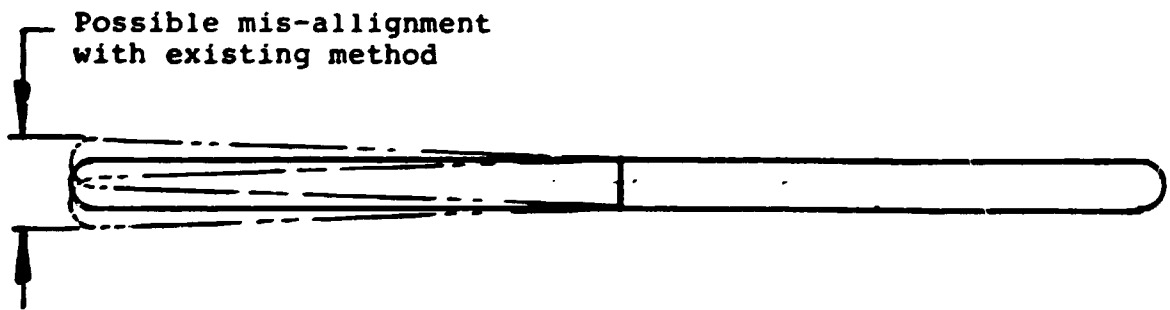
Each part has two 90° bends and one end is swedged to a smaller diameter so that the two parts can be assembled by slipping the reduced diameter of one part into the un-reduced end of the other. When the two halves are assembled, together they have the shape of a rectangle.

See sketch #3 on page #14





Long swedge to minimize misalignment



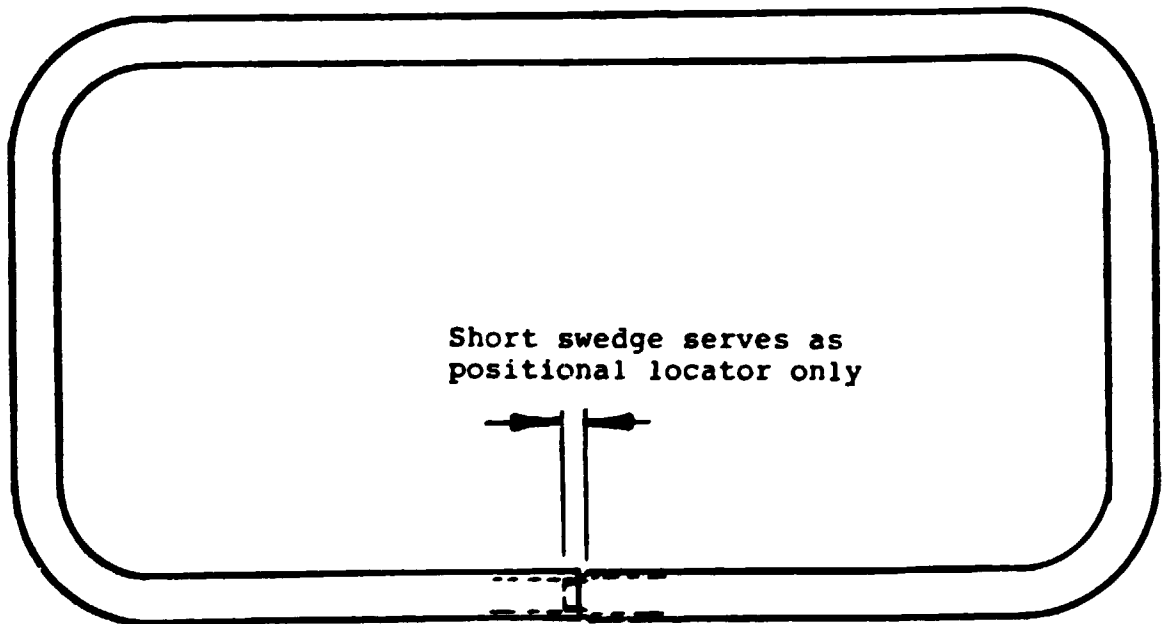
Because of the two piece construction and the possible center distance inaccuracy from one part to the other it is hard to make the parts fit together properly with the least amount of play. Any play can cause misalignment as shown in sketch #4.

In order to reduce the misalignment, the swedged ends of the tubing have to be longer and if those swedged ends are longer, it is much harder to assemble the two parts.

Therefore the customer asked if we can think of another method of manufacturing this tubular frame.

After a little discussion I suggested to make the frame out of one piece of tubing and with four 90° bends as shown in sketch #5

This new method will eliminate the misalignment completely and I suggested that the swedged end should be as short as possible since it only serves as positional location, where with the old method with two joints it is necessary to have long joints to achieve alignment with the two frame halves.



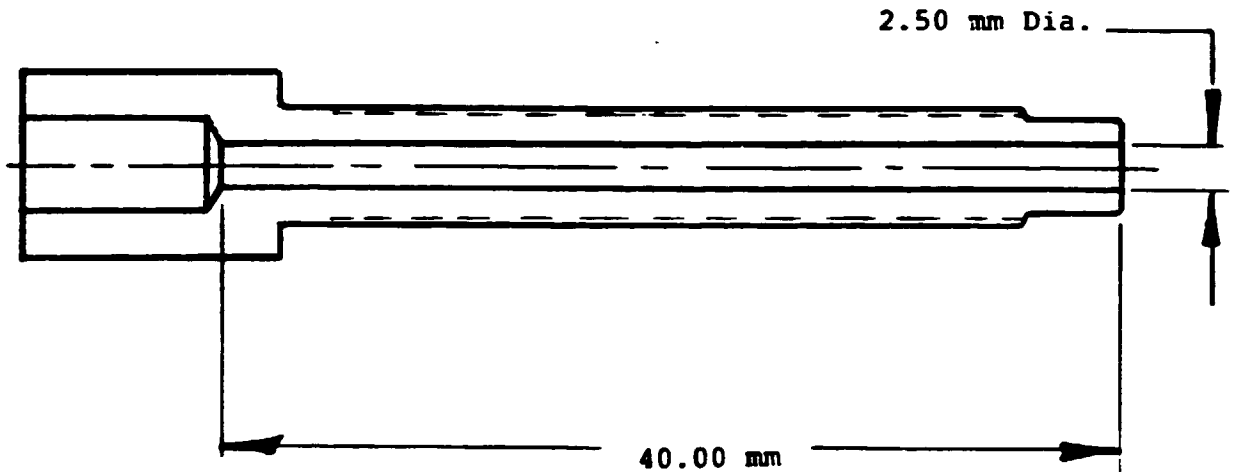
SKETCH 5

Jin Sung Precision Ind. Co.

Project #2

(Brake cable adjustment screw for motor cycles)

(See sketch #6 below)



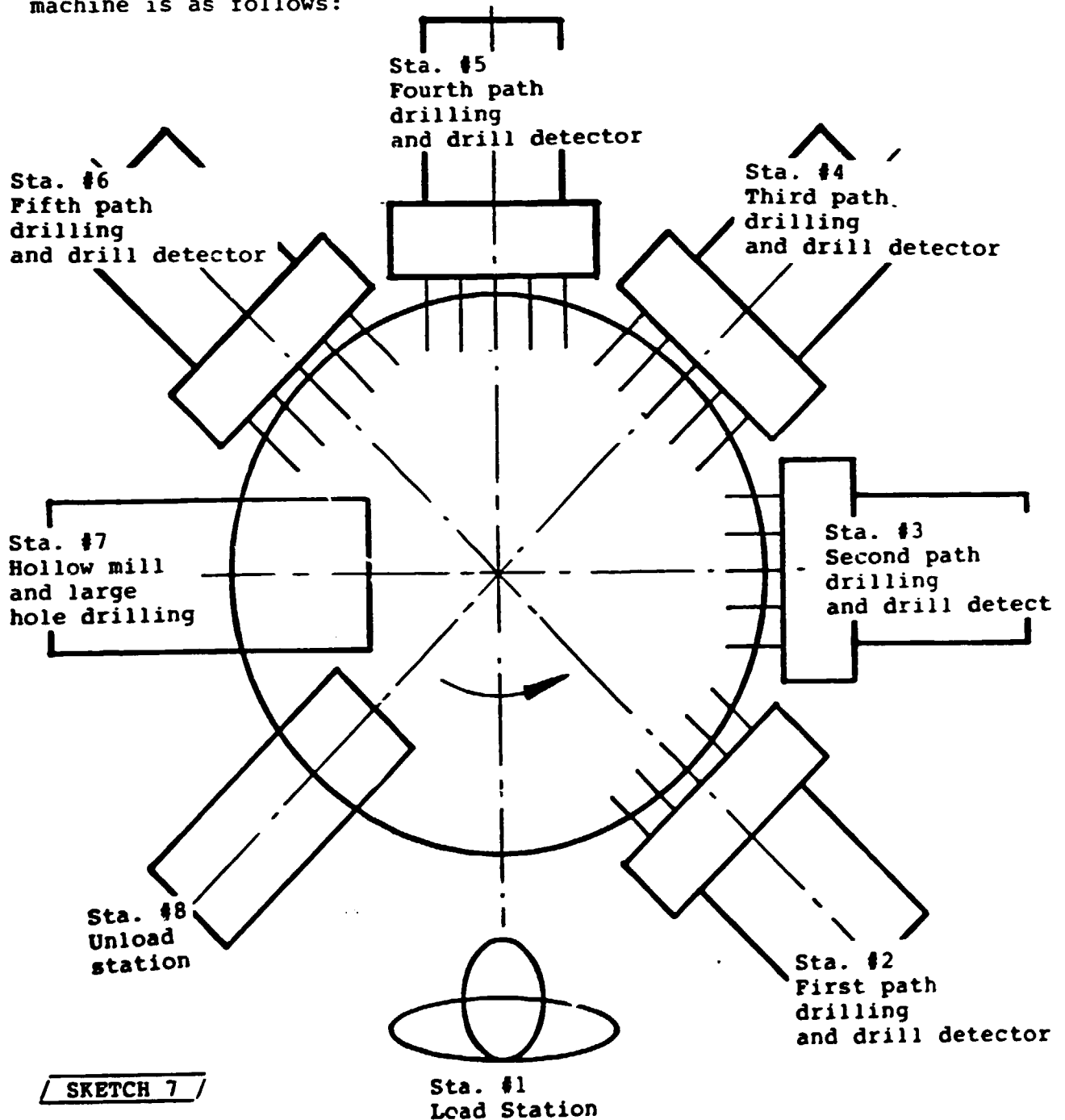
SKETCH 6

The only operation on this part that presents a problem is the 2.5 mm Dia. hole that has to be drilled 40.0 mm deep thru the axis of the part.

After discussion of production rate requirements, I suggested to use an indexing machine with multi spindle heads, so that we can achieve this drilling operation with several paths.

I pointed out that it is better for the chip removal flow if the drilling is done horizontally and the diameters of the drills from one path to the other have to decrease slightly to prevent drill breakage.

The concept of the multi station multi spindle head drilling machine is as follows:



The method of the above drilling indexing machine does not allow for the separation of good parts unload from rejects unload.

When a broken drill is detected in any of the drill heads, the machine will stop and the operator has to replace the drill and remove the part with the broken drill.