Analysis over the Improvement Due To Change Indesign of Some Cutting Tools

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Abstract— We can obtain the better results in productivity, quality, reliability and machinability etc if some changes are provided in design of cutting tools. For this we may provide the basic changes in cutting tool profile as various cutting angles, cutting edges, cutting points etc.

Keywords: Productivity, Quality Machinability, Tool Geometry and Reliability

I. INTRODUCTION

In the industries the good mrr, less cycle time, few material loss, less wastage of time etc. are important factors to achieve and for this there are various type techniques used related to cutting tool, related to operations, related to material handling etc. In which the improvement related to the cutting tool is more important for the production industries because here the productivity is main factor which may be maintained at any cost. For mass production the tool should be made such type that it may produce the large number of products in less time consumption. For this the required changes are necessary in the cutting tools.

II. METHODOLOGY OR LITERATURE SURVEY

Methodology related to change in design of turning tool – Mostly it is seen that the single point turning tool fails suddenly if the high machining parameters are used. Means its cutting edges are blunted and by this the metal removal rate is decreased suddenly. If we provide such type change in design of the turning tool that the working load is divided on more than one point than we can avoid the sudden blunting of the turning tool. By this not only metal removal rate will improve sufficiently but also the tool life will be maintained better. The time required to complete the operation will be reduced sufficiently which is also responsible to improve the tool life.

A. Methodology Related To Change In Design of Boring Tool

Like turning tool the boring tool is also used to remove the material from the cylindrical workpiece so it is clear that the problems are same as occurred in the turning operation. Means it also becomes blunt suddenly and may fail at any time after that. So to eliminate these problems till a limit we can provide some required changes in the design and may divide the working load over the more than one point.

B. Methodology Related To Change In Design of the Slotting Tool

If the slotting operation is completed on slotting machine than at such condition the single point slotting tool fails suddenly or blunted due to continuous working, obviously. Now if we shift the all working of single cutting edge slotting tool to the double edge slotting tool then it may be eliminated till a limit. Here we can design the slotting tool in two ways as following.

C. When the Wide Slot Is Required

If we want to obtain the wide slot on less time consumption than at such condition the single edge slotting tool will be insufficient. Here if we provide some change in design of slotting tool and convert it in three edged tool then such type wide slots may be achieved fastly. Here the first edge is provided at top side while the other two edges are provided at both sides of the first edge some back to it.

D. When the Deep Slot Is Required

If we want to obtain the deep slot on less time consumption than at such condition the single edge slotting tool will be insufficient. Here if we provide some change in design of slotting tool and convert it in two edged tool then such type deep slots may be achieved fastly. Here the first cutting edge is provided up side and second cutting edge is provided at some down side vertically at same axis. But a particular horizontal gap is provided between both edges for easy removal of the chips.

III. ANALYSIS

A. Analysis Related To the Turning Operation

The single point turning tool is blunted and failed suddenly if works continuously at some high machining parameters. If we provide some change in its design and geometry, we can improve the tool life of the turning tool.

B. Analysis over the Change in Design of the Turning Tool

Here the single point turning tool is converted into double point turning tool as fig.(B). By this the metal removal rate is increased sufficiently and the tool life of the tool is also increased sufficiently because the working load is divided in two parts and operational time is reduced about to 40 to 50%. Here this type turning tool further may be designed in three ways. In first way the both points of the tool are made same and remove the same amount of material. Here the maximum amount of material is removed and pure turning operation is provided. So it is clear that here the surface finish is not obtained so well.

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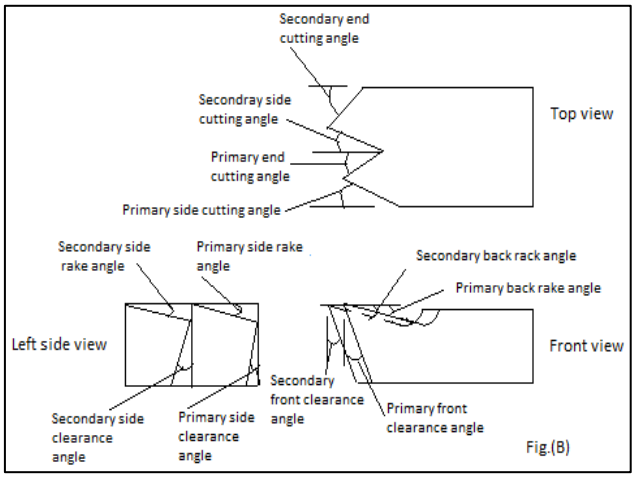
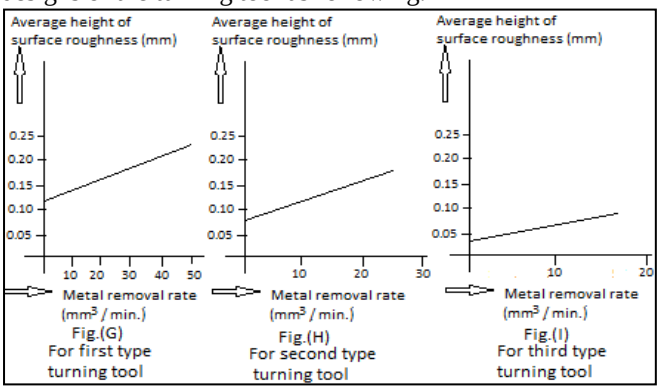


Fig. B:

In second way the first point of the tool is made for turning purpose but the second point only removes 20% material in comparison with the first point. So it is clear that here better surface finish is obtained after completing the operation. In third way the both points of the tool are made for finishing of the workpiece, here the both points are sharpen and strengthen sufficiently so that it is stable at working condition. Here only 10 to 20 % material is removed totally .The machining parameters as feed, depth of cut are taken minor while the linear velocity is taken 25% high. So it is clear that the fine surface finish is obtained if various type problems are controlled sufficiently as vibration, chattering, loose capturing etc. Here for turning, the values of both type rake angles and both type clearance angles are taken 10 to 15° maximum while for finishing their values are taken 15 to 20°.

C. Analysis over the Relationship between Metal Removal Rate and Surface Finish –

Here it is clear that if surface finish is also required with high metal removal rate then it is not possible because it becomes very difficult to maintain good working conditions at high metal removal rate. Means vibrations, chattering, whirling and loose capturing etc. type problems are occurred. Now draw the graph between metal removal rate (mm^3/min.) and average height of surface roughness (mm) for all three type designs of the turning tool as following.



Here it is clear that as well as the metal removal rate is increased the surface finish value is decreased continuously.

Analysis over the relationship between average height of roughness (k) and machining parameters as feed per min.(f), depth of cut (d), linear velocity (v) and internal resistive force of the workpiece material (R_i) – Here we will have to use the Buckingham's π-theorem to find the relationship between these values.

Now by using Buckingham's π-theorem we can write as →

$$f(d,v,R_i,f,k) = 0 \quad \rightarrow \text{Equation (A)}$$

Then number of variables (n) = 5

Now on putting the all dimensions of all variables →

$d = (L)$, $v = (LT^{-1})$, $k = (L)$, $R_i = (MLT^{-2})$, $f = (LT^{-1})$

So the number of dimensions (m) = 3

So the number of π – terms = 5-3 =2

So we write as $f_1(\pi_1, \pi_2) = 0$ → Equation (B)

Where $\pi_1 = (d^{a1} * v^{b1} * R^{c1}{}_i * k)$ → Equation (C)

$\pi_2 = (d^{a2} * v^{b2} * R^{c2}{}_i * f)$ → Equation (D)

Now on putting the all dimensions on both sides in Equation(C) →

$$(M^0L^0T^0)=\{(L)^{a1}*(LT^{-1})^{b1}*(MLT^{-2})^{c1}*(L)\}$$

On comparing the dimensions on both sides →

$a1+b1+c1+1 = 0$ → Equation (E) ,

$-b1-2c1 = 0$ → Equation (F)

$c1 = 0$, then from Equation (F) → $b1 = 0$

then from Equation (E) → $a1 = -1$

then again from Equation (C) → $\pi_1 = (k / d)$ → Equation (G)

Now on putting the all dimensions on both sides in Equation (D) →

$$(M^0L^0T^0)=\{(L)^{a2}*(LT^{-1})^{b2}*(MLT^{-2})^{c2}*(LT^{-1})\}$$

On comparing the dimensions on both sides →

$a2+b2+c2+1 = 0$ →Equation (H),

$-b2-2c2 -1 = 0$ → Equation (I)

$c2 = 0$, then from Equation (I) →$b2 = -1$

then from Equation (H)→ $a_2 = 0$

then again from Equation (D) → $\pi_2 = (f / v)$ → Equation (J)

Then from Equation (B) →$f_1(k / d, f / v) = 0$

Or $k = d * \phi(f / v)$ or $k \alpha \phi(f / v)$ → Equation (K)

According equation (K) it is clear that the value of k depends on the value of $\phi(f / v)$ if d is constant. Means the value of k will be minimum if the value of f is minimum and value of v is maximum till a limit. It is also clear that the value of k does not depend on the value of R_i.

– Note – Here we can use the two bits at both points of the turning tool. The horizontal gap between both points may be adjusted by using adjustable type bit seats and by using corresponding sizes of the bits. To fix the bits properly over the tool the different – different type seats may be used according the size of bits.

D. Analysis Related To Boring Operation

The boring operation is also used at large scale in manufacturing where the hole enlarging operation is required.

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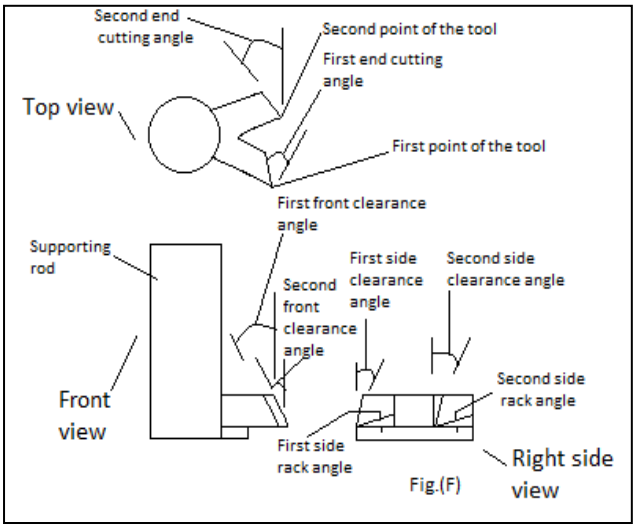


Fig. F:

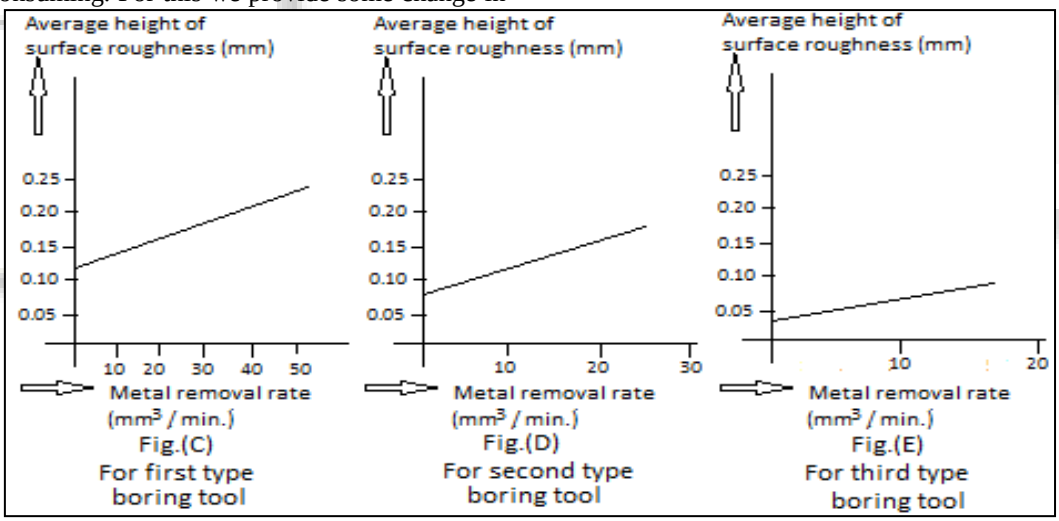
But sometimes the fast manufacturing is required to obtain the production target at certain level like in mass production.

E. Analysis over the Change in Design of the Boring Tool – Here the single point boring tool is not sufficient to achieve the required production target, here we have required to design such type boring tool which may cut the material fastly in less time consuming. For this we provide some change in design and convert the single point boring tool into the double point boring tool like as in turning tool. Here also we may design it in three ways as →

- Pure boring tool – Here the both points of boring tool are used to bore the material fastly.
- Boring plus finishing tool – Here the first point of the tool used to bore the material fastly but the second point only removes the minor material and gives the good finish.
- Pure finishing tool – Here the both points of the tool are used to finish the hole only. Besides it here both the feed and depth of cut are provided minor and linear velocity is increased by 25% in comparison with normal linear velocity.

F. Analysis over the Relationship between Metal Removal Rate and Surface Finish

Here it is clear that if surface finish is also required with high metal removal rate then it is not possible because it becomes very difficult to maintain good working conditions at high metal removal rate. Means vibrations, chattering, whirling and loose capturing etc. type problems are occurred. Now draw the graph between metal removal rate (mm^3/min.) and average height of surface roughness (mm) for all three type designs of the boring tool –



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G. Analysis over the Slotting Operation

Here the slotting tool may design in two ways, first type design is used to obtain the wide slots and second type design is used to obtain the deep slots.

H. Analysis over the Design of Slotting Tool Used For Wide Slots

Here if the slotting tool is designed according fig.(J), the 60% material will be removed by first cutting edge and 40% material will be removed by second cutting edge in one stroke. By using two cutting edges one by one serially the width of chip is increased sufficiently than thickness. By this the number of strokes required to find the exact wide size of slot are reduced. In resultant the time required to obtain the slot is reduced sufficiently. The second cutting edge also helps to obtain the finish of the slot sufficiently.

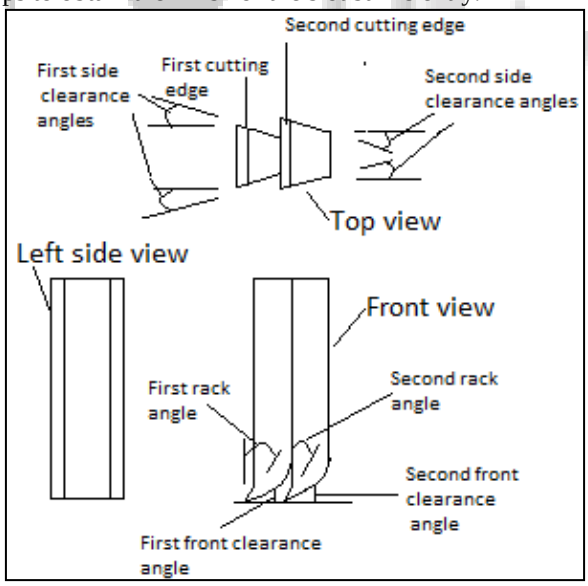

Fig. J:

I. Analysis over the Design of Slotting Tool Used For Deep Slots

Here if the slotting tool is designed according fig.(I), the 50% material will be removed by first cutting edge and 50% material will be removed by second cutting edge in one stroke.

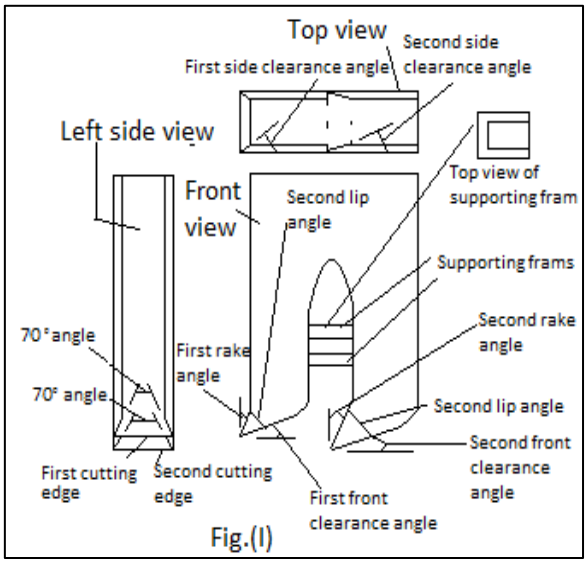

Fig. I:

By using two cutting edges one by one serially the deep slot may be obtained in less time consuming. Besides it the number of strokes required, are reduced sufficiently. Here the surface finish is also obtained better after completing the operation if the second cutting edge is made some harder and sharp.

IV. FINAL RESULT

By providing such type changes in design of cutting tools a better result may be obtained in production industries because the production target may be achieved at right time. Besides it the scrap or wastage is reduced sufficiently till a limit and better quality is achieved over the entire production. By this the good performance is maintained by the production industries.

V. CONCLUSION

Hence we can find the better results by providing some required changes in cutting tools.

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