International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 08 | Aug 2020 www.irjet.net p-ISSN: 2395-0072

Adjustable Portable Table Attachment

Bhaskar Bhattacharjee[1], Anoop Pathak[2], Adarsh Kumar Kuiya[3], Ashi Gupta[4], Prof. MK Gaur[5]

[1,2,3,4]*Students,Department of Mechanical Engineering, Madhav Institute of Technology and Science, Gwalior, Madhya Pradesh, India*

[5]*Professor,Department of Mechanical Engineering, Madhav Institute of Technology and Science, Gwalior, Madhya Pradesh, India*

Abstract - *The conventional style fixed desks are highly uncomfortable and are taking a heavy toll on body and mental health. The traditional furniture used in industrial spaces are not ergonomically designed and are leading to eye sight disorders, fatigue, postural defects, backaches, etc. Several IT professionals, industrial workers etc. suffer from eye strain, headaches etc. due to longer sitting hours. Students of schools and colleges have also eyesight problems to see distant black boards due to different heights so, hinder the visibility of the children. Solution to this problem lies in the use of this portable attachment fitted to any conventional table thereby, preventing the costs of replacement. A unique kinematic and ergonomic design has been determined by computational analysis so that an attachment with appropriate load carrying capacity can be developed. The basic design structure includes an aluminum plate, 6 links and 6 spring joints so that a 3-D motion can be generated and tilting is permitted by the locking of the joints in the grooves generated by mechanical machining of the groove spacing. A weight carrying capacity of 2-5 kg may be achieved as visualized in test results. A costing analysis with a criteria evaluation study has been conducted on this project, where the optimized design has been rated by potential users on a rating scale of 0-5. Lastly, cost of up gradation for industries from conventional style architecture to the use of attachment proposed has been calculated to conduct a feasibility study. The future scope of this design lies in its vast scope and market for use in modern tech industries, schools, colleges, pharmaceutical purposes and so on.*

1. INTRODUCTION

Conventional Style tables have been a major cause of concern for the working population, IT professionals and students around the country as they suffer due to non ergonomic design of this primitive furniture. These old style tables affects the eyesight of working individuals which can also lead stresses over longer hours. People who are working continuously sitting for longer hours have been getting sprains, back aches and several postural disorders due to lack of comfort leading to excessive expenditure for the companies and workforce. Students of schools and colleges have also eyesight problems to see distant black boards due to different heights so, hinder the visibility of the children. Changes in existing fixed height conventional table can be beneficial not only to save health expenditure but also improve productivity.

The changes in the design of conventional table proposed in this paper are based on two key ideas portability and ergonomics. The design changes should be such that the cost of design modification should be feasible in the long run. The objective of this paper is achieved by a portable attachment that can be clamped to any existing table and given a three dimensional motion according to the requirement of the working individual.

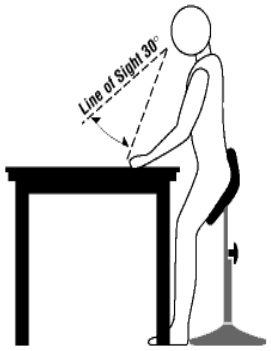

Fig. 1[11] – The conventional style tables

1.1 Eyesight and associated disorders

Visual discomfort among working individuals is a problem that has been a major cause of concern. Eyesight is related to the focusing of the incoming light to the proper area of eye's retina whereas vision is related to the interpretation of this received information by the human brain. The light travels through the cornea, the anterior chamber, the pupil, the vitreous body and finally to the retina where it is converted into nerve impulses. The symptoms which accompany longer sitting hours on fixed desks and focusing on digital interfaces like computers etc are eyestrain, blurred distant or near vision scientifically referred to as myopia or hypermetropia, dry or red eyes, back ache and light sensitivity. If the attachment design described is used in the workplace, the user can adjust his computer or book height as per his requirement and several eyesight problems can be avoided and a certain degree of comfort leads to increase in productivity.

2. Literature review

Research on different design of table:

1. Douglas G. wright in his patent publish on 21 feb 2008 in united state patent application publication on folding table and chair describe the arrangement of their table and chair which have foldable types of legs that cannot be seen when they are in fold condition. It also contain a hinge at the table end so after folding the table it can be easily carried by the person. It is very much suitable for those house, office, store, shop which have less space as it occupy very less space.
2. Alan berkowitz; Elliot w.baum both of St. Louis MO; curt angle St clair, III publish patent on 5may 1992 on folding table in united states patent. In their patent there table contain legs which are pivoted to underside of the table. A lock mechanism is also present there which help the legs to get lock at there position and also a releases mechanism is also there help the legs to get unlock.
3. Nielsdiffrient, Ridgefield,conn. In his patent publish in united states patent on feb,13,1996 on folding table mechanism shows a table which contain T-legs which can be easily folded under the side of the table . spring loaded cam is present on each side of the housing slide in slotted frame under the table. Locking shoulder is provided which help to get lock at s particular position and a lever to unlock the cam.
4. Taizoabe, ichikawa, japan publish a patent on sep, 11, 1990 in united state patent on folding table. According to his design the table can be folded when not in use. The table can be used in horizontal and slightly tilted state. On each side there is a lock mechanism to lock the legs present within the housing .locking mechanism contain first member, second member and locking disc is also present in the mechanism. First and second member can be easily lock which prevent any kind of shaking of the table.
5. Joseph A Erpelding and Lawrence P Erpelding in 1937 publish a research paper on Folding chair structure. The chief object of the invention is to provide a simplified brace and latch construction for a folding chair of the collapsible parallelogram type. The chief feature of the invention consists in cooperative relationship between a brace coining plate or guide, a cooperating spring structure and release, and the brace associated thee with.
6. James A Weagle in 1972 published a research paper on folding table leg. Each of two folding leg standards constituting supports for a table is pivoted to its own bracket on the underside of the table and folds between upright and generally horizontal positions. A stop connected to the bracket defines the upright position while at the same time a dog slidable in a portion of the standard becomes engaged with a detent to hold the standard erect.
7. James K. Wilmore in 1994 publish a research paper on folding table. A folding table has table top halves of molded plastic which are hinged together along a transverse center line of the table by a hinge assembly which includes spaced hinges with a common hinge pin. The hinge pin forms a carrying handle for the table which is exposed when the table is closed and which is concealed between the table top halves when the table is opened.

3. Design

In order to provide a human full comfort the attachment required three motion.

i) Horizontal motion or sliding motion

ii) Vertical motion or lifting motion

iii) Inclination motion.

Horizontal motion maintains the distance between normal table and the attachment. It cover up the distance between the user and the table.

Second motion or vertical motion is used to maintain the distance between user eyes and table. It help the user to change the focal length according to him/her. the third emotion for installation motion is used to provide relaxation to the user neck.

Construction:-

The basic parts of the attachment are as follows-

1. 6 Rectangular bar

2. 6 special joint

3. 2 C- clamp

Dimensions of parts:

1. Rectangular bar - 1cm×3cn×20cm

2. Joint - diameter of joint 3cm

Thickness of joint 1cm

3. Aluminium plate - 35cm×20cm

Thickness -2mm

The material of rectangular bar is aluminum. The special join is made by steel spring and plastic.

Joint:- joint is made by spring mechanism a plastic plate is -attached to one end of the string and the second end is fix. This joint has mainly two parts outer case and inner core. There are 12 holes in outer casing and there are 12 teeth in inner casing part. These teeth are inserted in this holes of outer casing. When we press the plastic plate by thumb it compresses the spring by this teeth are moving inward so

outer casing is free to move so we can set it as per our comfort angle and when we release it the teeth again move in forward direction and inserted in those holes.

Fig. – 2 The links of the attachment

Fig. 3 – Base table for portable attachment

Fig 4 – All the aligned joints together

Fig 5 – The portable table attachment

4. Cost and Feature based Analysis

In order to select the final table(i.e. conventional or adjustable), the features and possibilities with its advantages and contras of each of the variants have been taken into account. The method use is the criteria evaluation rating method.

The different variants were rated related to the requirements of the business value and the user value and also costs. In order to score each solution, it has been used a five- point scale because it is sufficient in this case.

Business value criteria:

- Comfortable table
- Tilting system
- Variety of users
- Performance
- Clean
- Robust
- Simple
- General aesthetics

User value criteria:

- Possibility to place the table to work in groups
- Adjustable in height
- Easy to use
- No pinching risk
- Compactness
- Ergonomics

User Value Criteria	Ratings	
	Con. table	Adj. table
Adjustable in height	3	5
No pinching risk	4	4
Easy to use	5	4
Compactness	5	5
Ergonomics	5	4
Possibility to place the table to work in groups	5	2
Score user value	22	22

Business value - Criteria	Ratings	
	Con. Table	Adj. Table
Comfortable table	5	5
Tilting system	0	5
Variety of users	3	4
Performance	5	4
Clean(impression)	4	5
Robust(impression)	5	4
Simple(impression)	3	5
General Aesthetics	4	4
Stability	5	3
Manufacturing	4	5
Score business value	38	44

As it can be seen from table, the conventional table received lower scores for business value and higher score for user value than adjustable table. Since both table have very similar total scores, and one each one is better in one value, the final decision is to create the final concept mixing things from both table, even if conventional table is going to be used as the base, because is the one that has received better scores in user value.

Thanks to this method, it is possible to compare which things are better in each concept in order to improve them in the final one. Now from above discussion we can clearly say that adjustable table has better total score than conventional table.

Hence we can manufacture adjustable table attachment at large quantity.

Cost Matrix of Adjustable Table:

Piece	Material	Density	Mass	Cost
Table Surface	Aluminium	2700 kg/m^2	200 gm	Rs. 200
Bars	Aluminium	2700 kg/m^2	400 gm	Rs. 250
Joints	Steel	7700 kg/m^2	250 gm	Rs. 180
Total			850 gm	Rs. 830

Total cost of manufacturing single adjustable table attachment =Rs 830. Typical conventional table cost around = Rs 3500~Rs4000. Hence it is economical and aesthetical to use Adjustable table attachment

5. CONCLUSIONS

This portable attachment is my response to the problems of eyesight, postural defects due to use of continuous conventional tables. Also the adjustable nature of our table attachment makes it suitable for people of variable heights and make them work comfortably.

We have designed a table which can have three motions horizontal, vertical& inclined by using aluminium plate which helps it making light in weight and links and steel spring joints. We have done the kinematic analysis of all the motions hence developing a structure which provides comfort, stability, compactness and general aesthetics.

Finally, we have done the analysis based on both user value and business value criterion which proves our table to be better than conventional table. Also, the cost analysis is done which shows this table to be economically sound than conventional table.

Hence the table attachment is economical, ergonomical & aesthetic.

Further development of our product can help users for industrial, pharmaceutical, educational purposes.

ACKNOWLEDGEMENT

We, the students of Madhav Institute of Technology and Science are highly grateful to our faculty mentor, Prof. MK Gaur Sir for guidance and technical advice at all stages of design and development of this project. Lastly, God is the greatest researcher and deepest gratitude goes to him for enabling us with ideas and resources for the same.

6. REFERENCES

1. http://www.dailymail.co-.uk/news/article-3175192/Children-spend-30-minutes-time-iPads-suffer-chronic-neck-pain-later-life.html (Acc. 25 July 2016)
2. Form oMiljö http://www.formomiljo.se/ (Acc. 12 Aug 2016)
3. Kathryn Best MA, MSc (2011) What can Design Bring to strategy? Designing thinking as a tool for innovation and change, Inhollanduniversity of applied research, Rotterdam, ISBN 978-90-77812-33-4
4. An Introduction to Design Thinking PROCESS GUIDE (2010) https://dschool.stanford.edu/sandbox/groups/designresources/wiki/36873/attachments/74b3d/ModeGuideBOOTCAMP2010L.pdf?sessionID=68d

eabe9f22d5b79bde83798d28a09327886ea4b (Acc.31 July 2016)

5. School of furnishing, History of the desk (2014) http://www.schoolfurnishings.com/history-of-the-desk-2

6. Classroom design (2008) http://hermanmiller.com/research/solution-essays/rethinking-the-classroom.html (Acc. 29)

7. Ergonomics (2011) http://www.technologystudent.com/designpro/ergo1.htm (Acc. 15 June 2016)

8. Visual history of school desks (2012) http://www.edtechmagazine/k12/article/2012/10/visual-history-school-desks (Acc. 31 July 2016)

9. Posture science, how to have a good posture (2013) http://theramart.com/uncategorized/la-ciencia-de-la-postura-como-sentarse-recto-lo-hara-mas-feliz-mas-confiado-y-mas-saludable/ (Acc. 31 July 2016)

10. O.P Khanna – Industrial Engineering and Management.

11. Vijay Kumar, John Wiley & Sons (2012) 101 Design Methods: A structured approach for driving innovation in your organization ISBN-13: 978-1118083468

12. Design Better and Faster with Rapid Prototyping (2016) https://www.smashingmagazine.com/2010/06/design-better-faster-with-rapid-prototyping/ (Acc. 28 July 2016)

13. 3D modeling (2016) https://en.wikipedia.org/wiki/3D_modelling (Acc. 15 June)

14. Ergonomics – Environment, Health and Safety http://ehs.unc.edu/workplace-safety

15. Foldable table –US4955294A Inventor – Taizo Ape Current Assignee – Okamura Corp https://patents.google.com/patent/US4955294/en

16. Foldable table – US5109778A Inventor – Alan Berkowitz, Elliott W. Baum, Curt Angel Current Assignee : Howmet Corp, Berco Industries Inc https://patents.google.com/patent/US5109778A/en

17. Foldable table mechanism –US5490467A Inventor – Niels Diffrient Current Assignee – Howe FURNITURE Corp https://patents.google.com/patent/US5490467A/en

18. Foldable table and chair US20080042475A1 Inventor – Douglas Wright Current Assignee: Meco Corp https://patents.google.com/patent/US20080042475A1/en