IPRO 341
Design and Global Market Analysis of a Tool Product

Sponsored By: Versatility Tool Works
Who is VTW?

- Located in Alsip, IL
- Est. 1972
- Manufacturer of Sheet Metal Products
- Industrial Tool cabinet
OBJECTIVES

TESTING TEAM:

- Improve and enhance the performance of tool cabinet to increase durability

DESIGN TEAM:

- Develop a custom tool cabinet design to accommodate for the changing market
CONTINUATION OF IPRO 341

SPRING 2009
- Accuride® Rack Slides
- Increased drawer stiffness
- Shot peening

SUMMER 2009
- Roller bearing design
- Recommended thicker guides using harder material.
TEAM ORGANIZATION

**Faculty Advisors**
William Maurer
Sheldon Mostovoy

**VTW SPONSOR**

**Coordinator / Secretary**
Hyejin Park (MS)

**TESTING TEAM**
Saad Sarvana (leader) (ME, AE)
Jae Lee (Applied Mathematics)
Jeffrey Bart (MS, ME)
Mark Ende (AE, ME)
Shahmeer Khaliqdina (EE)
Raihan Rahman (EE)

**Design Team**
Sara Cantonwine (leader) (ME, MS)
Erica Pauley (ME)
Arencce Gowe (ME)
Thomas Hotz (ME)
Andrew Kitaka (ITM)
TESTING TEAM

SCOPE OF WORK

- Thicker material (Cor –Ten Steel)
- Increase in Hardness
- Accommodate varying loads
- Continue evaluation of new guides
PROCESS

OBSTACLES:

- Testing space
- VTW’s machine breakdown

APPROACH:

- Changing one or two variables per test
- Analyzing failed test results to implement further changes
TESTING

One cycle represents opening and closing of drawer
KEY COMPONENTS

Locking Mechanism patented by VTW

Restricted to one drawer opening at a time
TEST 1

TEST PARAMETERS:
- Thicker Guides (Cor-10 Steel)
- Load of 550 lbs
- Locking mechanism engaged

MODE OF FAILURE:
- Failed after 632 cycles
- Pivoting of drawer due to locking mechanism.
TEST 1

Left Guide Deformation 632 Cycles

Right Guide Deformation 632 Cycles
TEST 2

TEST PARAMETERS:
- Removal of locking mechanism

MODE OF FAILURE:
- Tests stopped after 3450 cycles
- Improper testing rig setup
- Testing rig was supporting ~ 120 lbs
TEST 2

**Left Guide Deformation 3450 Cycles**

**Right Guide Deformation 3450 Cycles**
TEST 3

TEST PARAMETERS:
- Testing rig readjusted
- Reduction of load to 450 lbs
- Locking mechanism engaged
- Installation of angle brackets under guides
- Reduction of moment on drawer slides

MODE OF FAILURE:
- Failed after 3486 cycles
- Left side roller required replacement after 500 cycles
- Major deformation of left drawer slide 0.078 in.
- Deformation region same as in trial 1

Current roller bearing contacts at black arrow
By removing material shown by yellow dotted line, the point of contact is moved to red arrow.
TEST 3

Left Guide Deformation 3000 Cycles

Right Guide Deformation 3000 Cycles
RECOMMENDATIONS

- Modify locking mechanism to use roller bearings instead of rubber blocks
- Angle brackets must be included in future design
- Incorporate lower reduced bending moment on drawer slide
- A major improvement is strengthening of crossbars on sliding frame cost effectively.
DESIGN TEAM

NEW FEATURES:
- Rotating/detachable cabinet
- Lighting system
- Detachable toolbox
- Scratch resistant coating
- Push-to-open drawers
- Integrated computer and tracking system
- Pull-out work bench
ROTATING CABINET

- Innovative design not seen in tool cabinets
- Turn table
- Easy access to tools
- Not extended to full length of guides
  - = less stress on guides
- Space saver
ROTATING CABINET DESIGN
LIGHTING SYSTEM

- Long lasting LED
- Poor lighting in working environment
- Rotates to light draw position
- Magnetic Reed switches activate light when draw opens
- Hard housing for LEDs
DETACHABLE TOOL BOX

- Portability
- Fits into the existing cabinet
EXTRAS

Push-to-open Drawers

- stay ahead of the competition
- helps with overcoming static friction

Scratch resistant coating

- extend cabinet lifetime
- Texture powder coats
BARCODE TRACKING SYSTEM

- Records tool activity and history
- Must be scanned
- Handheld scanners or stationary
- Aluminum barcodes
  - scratch resistant
  - thin
  - inexpensive
EXAMPLE BARCODE

- 000000 would be the tool tracking number
TRACKING SYSTEM PROCESS

1. Insert ID
2. Work order
3. List tools
   - Tool available?
     - Yes: Scan tool
     - No: Show tool last_log
4. Tool use complete?
   - Yes: Log tool out (in_use)
   - No: Log tool in (Register location)
5. Quit (Log user out)
TRACKING SYSTEM

- Aluminum Bar Coding
DESIGN PROCESS

GOALS:
- Design features that add value
- Tracking system to manage tools

OBSTACLES:
- Features’ feasibility
- Spatial restrictions
- Tracking system compatibility
- Cost
Achievements:

- Overall design
- Thin LED system
- Longevity of outer surface
- Additional attributes
- Functional tracking system
RECOMMENDATIONS

- Continue development of usable tracking system
- Continue ideas and search for new innovations that will push this tool cabinet to the next level
- Prototype the tool cabinet precisely to utilize the stress analysis program
ETHICAL ISSUES

- Non-Disclosure Agreement
- VTW reputation
ACKNOWLEDGEMENT

- Versatility Tool Works
- Professors
  - William Maurer
  - Dr. Mostovoy
  - Russ
  - Craig