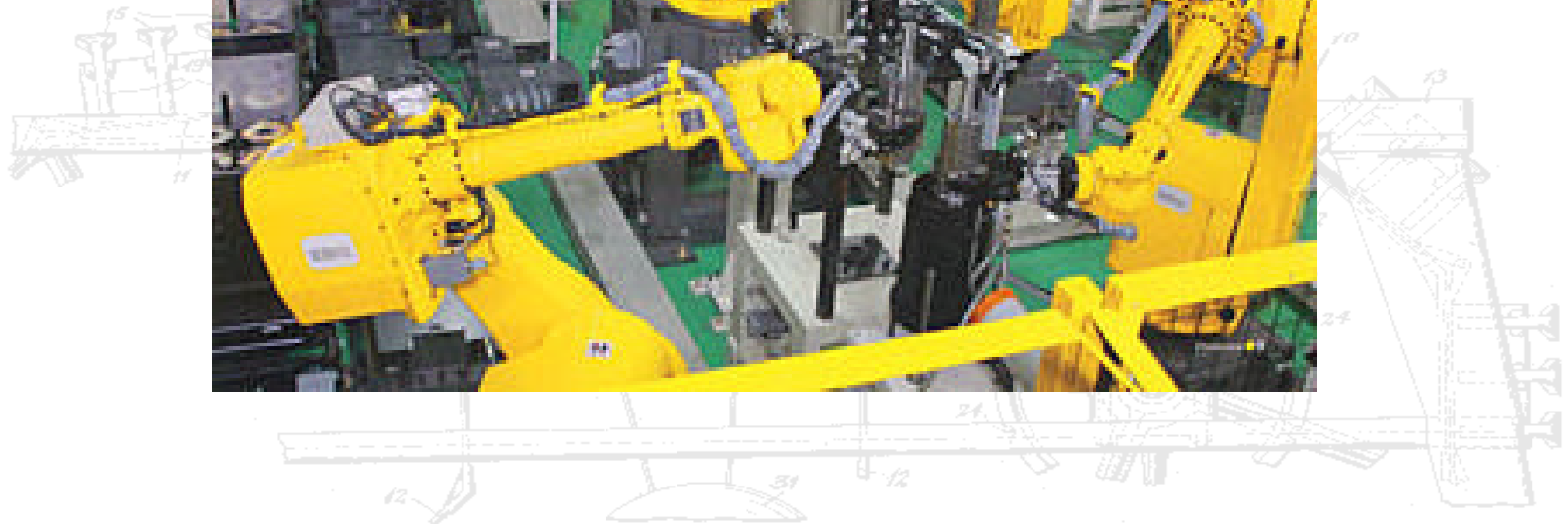


# The Logical Extension

- <http://www.youtube.com/watch?v=-SREct28IJM&NR=1>
- <http://www.fanuc.co.jp/en/profile/production/factory1.htm>



# Manufacturing for the other 90%

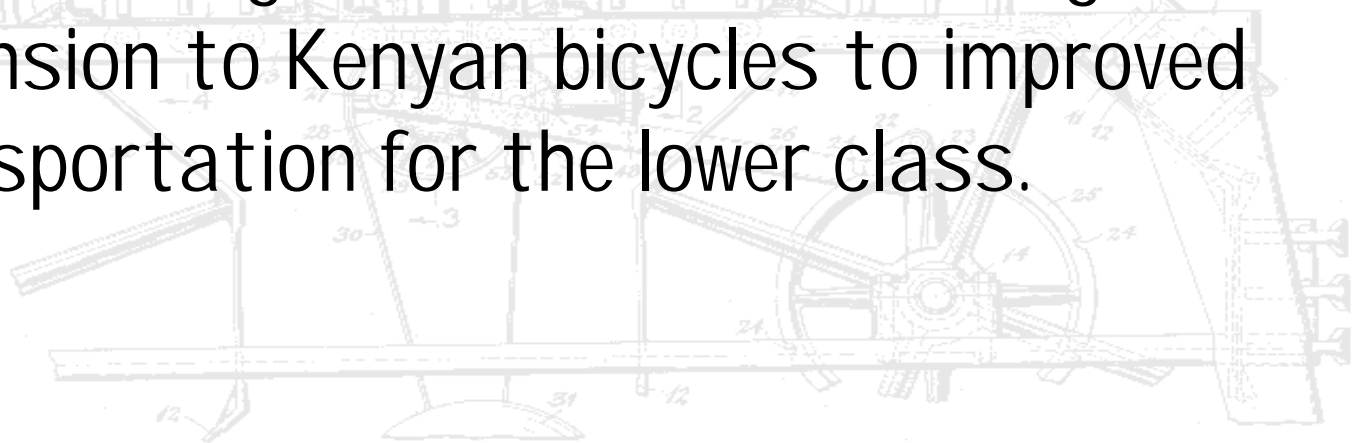
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## Manufacturing for the other 90%

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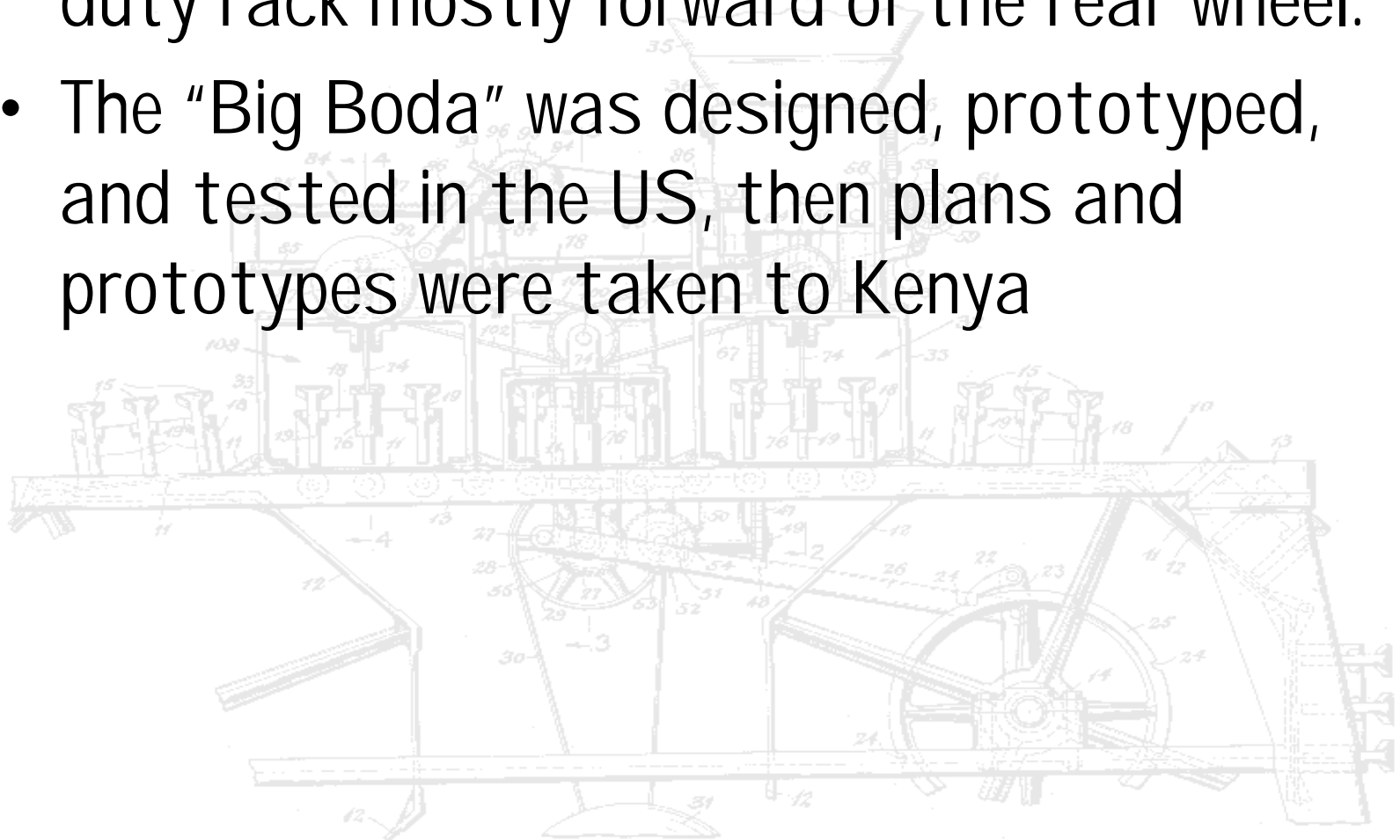
- Poor city people in Kenya may spend 30% of their income on public transportation.
- Boda-Boda bicycle taxi/messengers fill a vital role in Kenyan transportation
- The Boda-Boda is just a plain bicycle, not well suited to bulky or heavy loads.
- Worldbike.org set out to make a cargo extension to Kenyan bicycles to improved transportation for the lower class.



# Manufacturing for the other 90%

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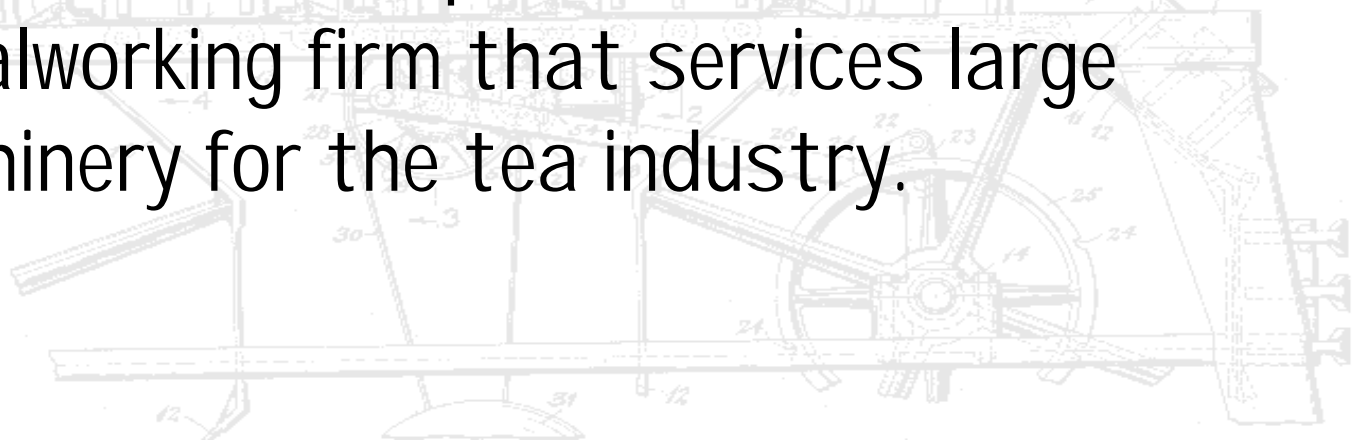
- The Worldbike “Big Boda” moves the rear wheel back about 15” and provides a heavy-duty rack mostly forward of the rear wheel.
- The “Big Boda” was designed, prototyped, and tested in the US, then plans and prototypes were taken to Kenya



# Manufacturing for the other 90%

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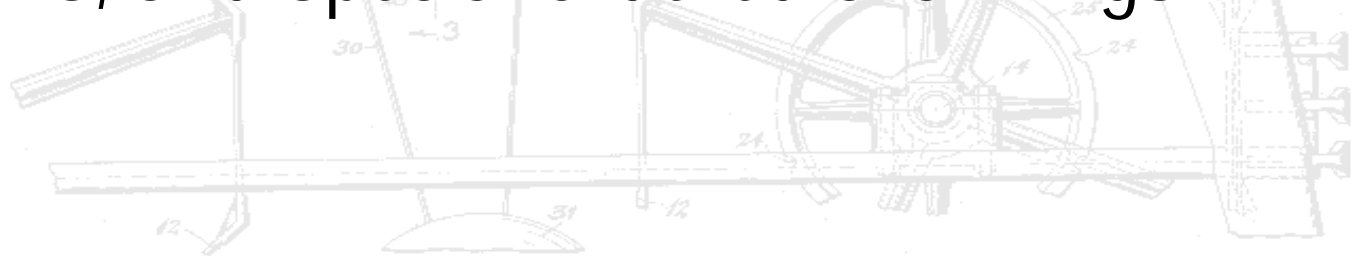
- Worldbike went to Kenya in May 2005 to find mfg facility
- Chose Kisumu, 3rd largest city w/ significant industrial sector.
- Recruited project lead in Nairobi through newspaper ad and 250 interviews
- Leased a workshop from an established metalworking firm that services large machinery for the tea industry.



# Manufacturing for the other 90%

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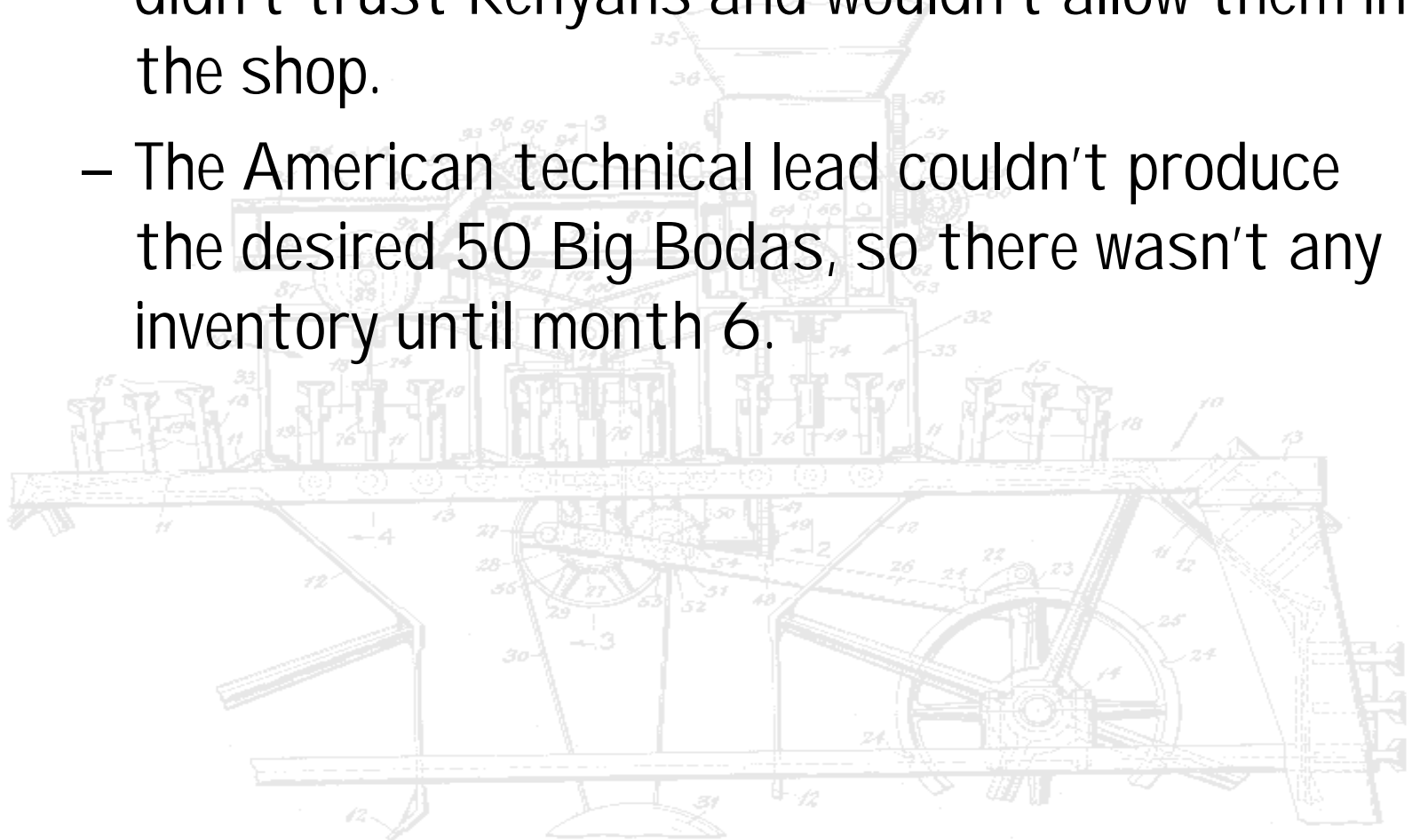
- Spent 3 months refining design, and building jigs and fixtures.
- Discovered problems with local bikes
  - welds and components prone to failure
  - ineffective braking under heavy load or in rain
  - no low hill-climbing gear
- Solution was emergency foot brake option, identification of the best of the (bad) brand options, and special ordered chainrings.



# Manufacturing for the other 90%

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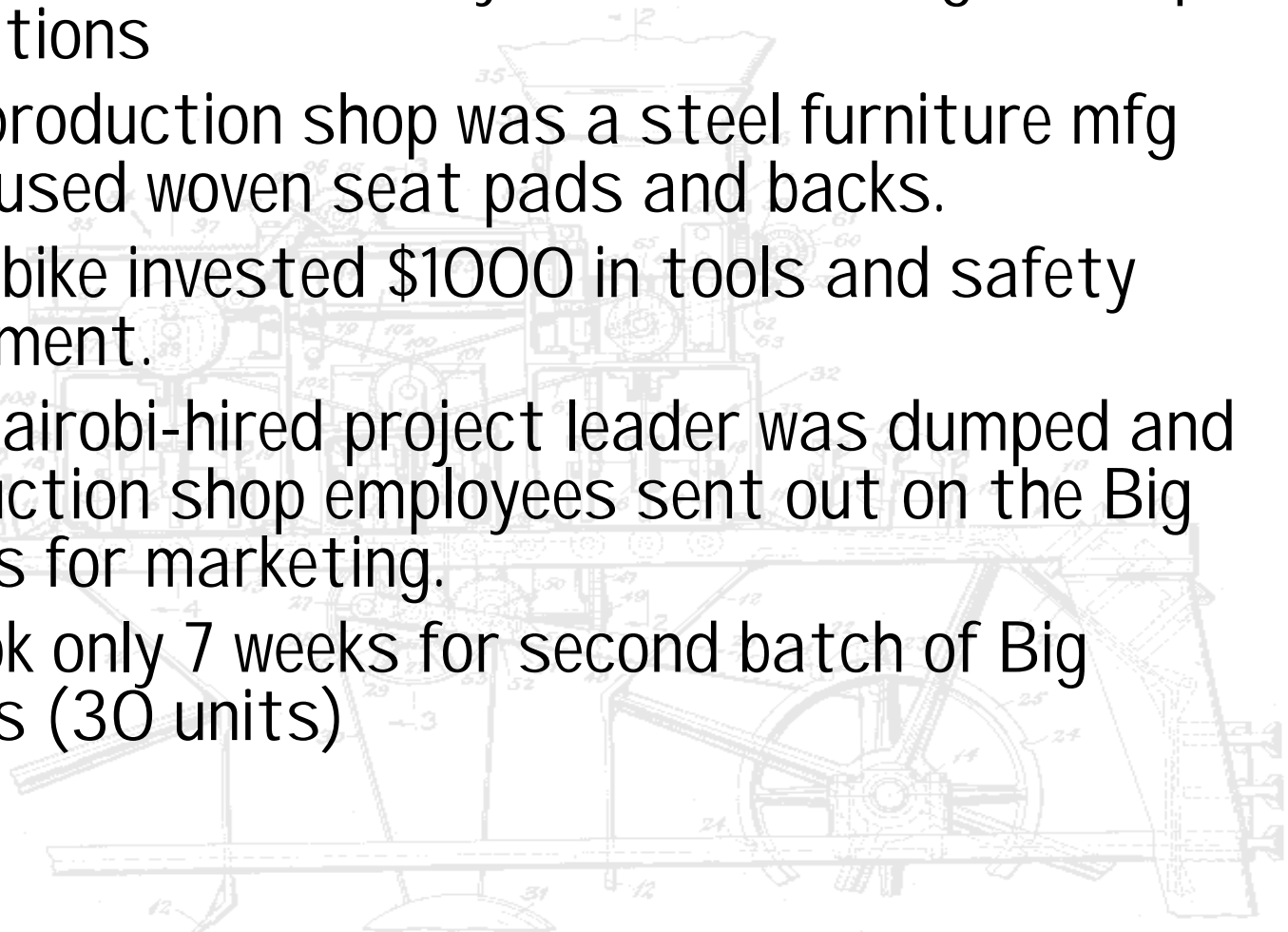
- Manufacturing startup problems:
  - Indian merchants who owned machine shop didn't trust Kenyans and wouldn't allow them in the shop.
  - The American technical lead couldn't produce the desired 50 Big Bodas, so there wasn't any inventory until month 6.



# Manufacturing for the other 90%

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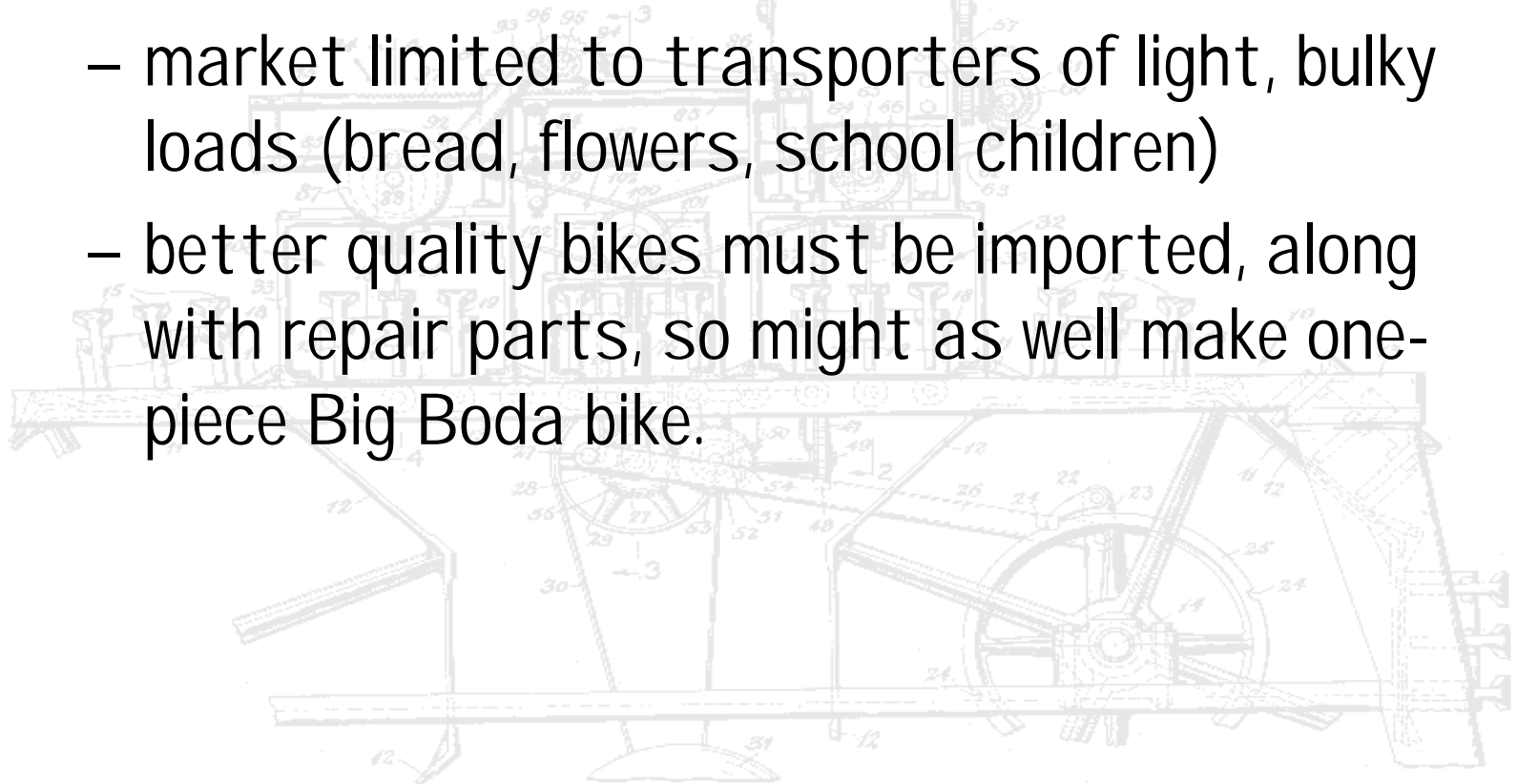
- In month 8, production was moved to a low-rent district shop run by Kenyans.
- The new area had many small-scale mfg and repair operations
- New production shop was a steel furniture mfg that used woven seat pads and backs.
- Worldbike invested \$10000 in tools and safety equipment.
- The Nairobi-hired project leader was dumped and production shop employees sent out on the Big Bodas for marketing.
- It took only 7 weeks for second batch of Big Bodas (30 units)



# Manufacturing for the other 90%

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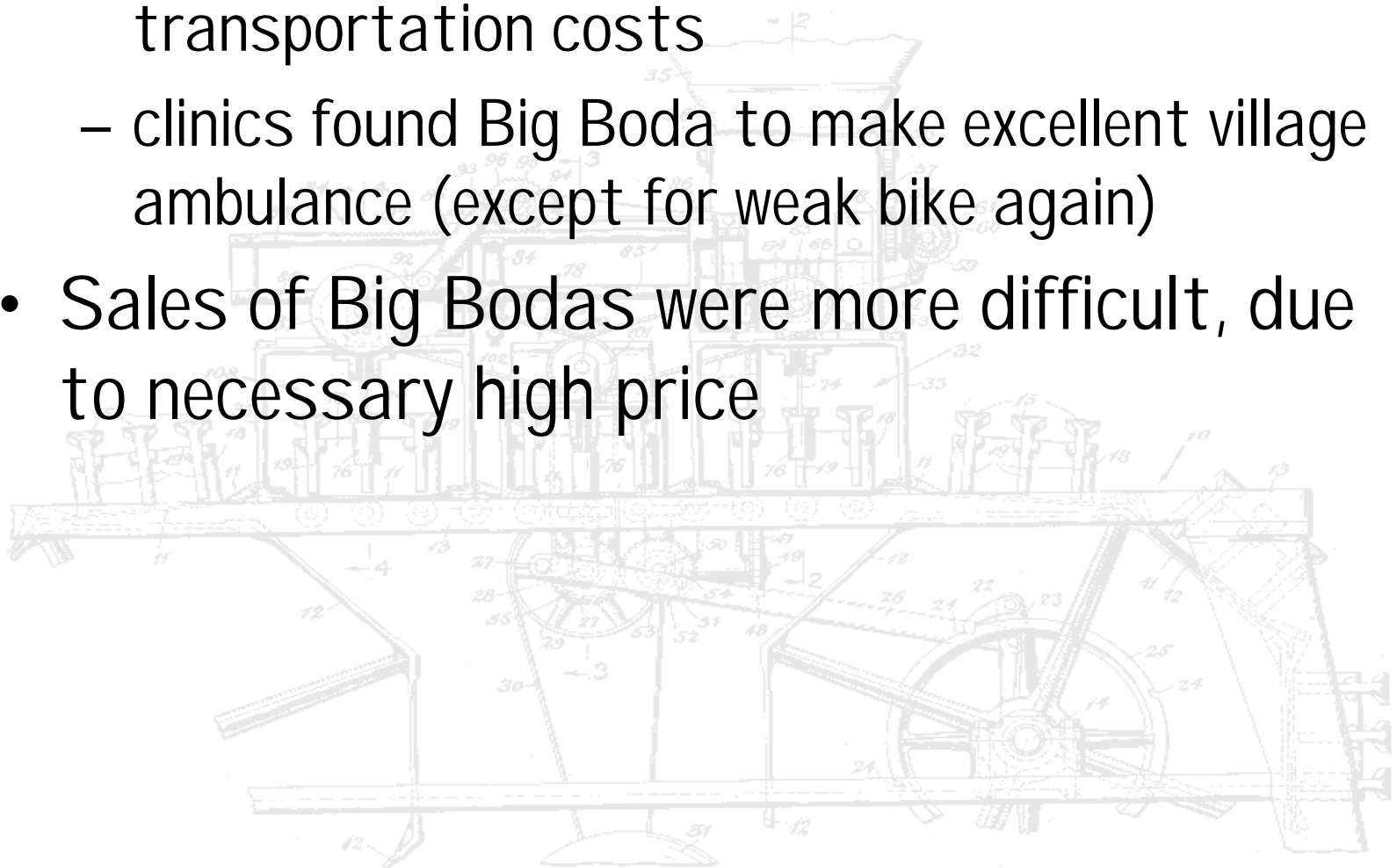
- Problems:
  - Big Boda extensions were strong, Black Mamba bikes were not. Average boda-boda operator spends 300KSH (\$5)/month on repairs
  - market limited to transporters of light, bulky loads (bread, flowers, school children)
  - better quality bikes must be imported, along with repair parts, so might as well make one-piece Big Boda bike.



# Manufacturing for the other 90%

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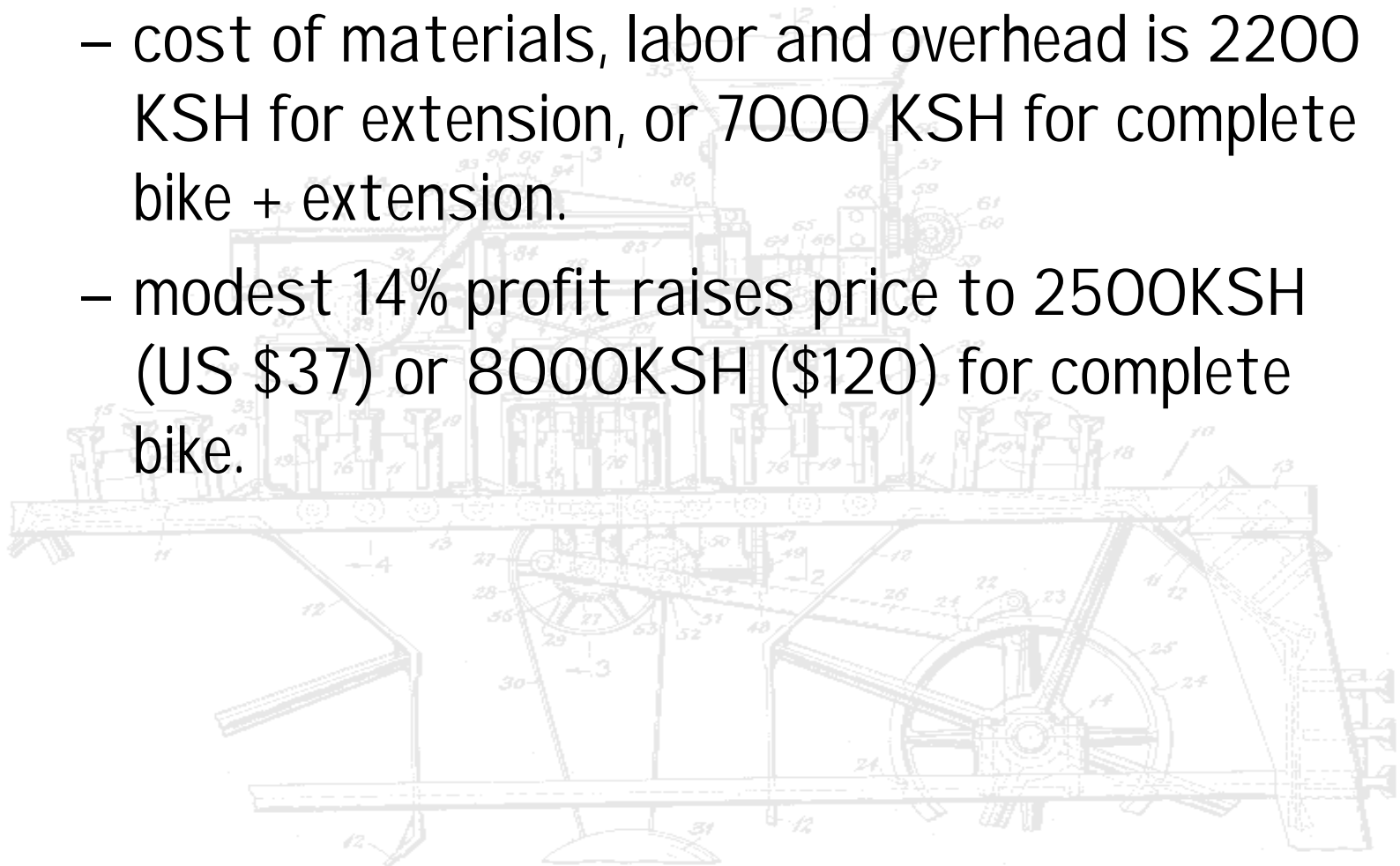
- Donated Big Bodas were very successful
  - orphanage saves \$5/day in reduced public transportation costs
  - clinics found Big Boda to make excellent village ambulance (except for weak bike again)
- Sales of Big Bodas were more difficult, due to necessary high price



# Manufacturing for other 90%

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- Costs:
  - 10 man-hours to fabricate and install
  - cost of materials, labor and overhead is 2200 KSH for extension, or 7000 KSH for complete bike + extension.
  - modest 14% profit raises price to 2500KSH (US \$37) or 8000KSH (\$120) for complete bike.



# Manufacturing for other 90%

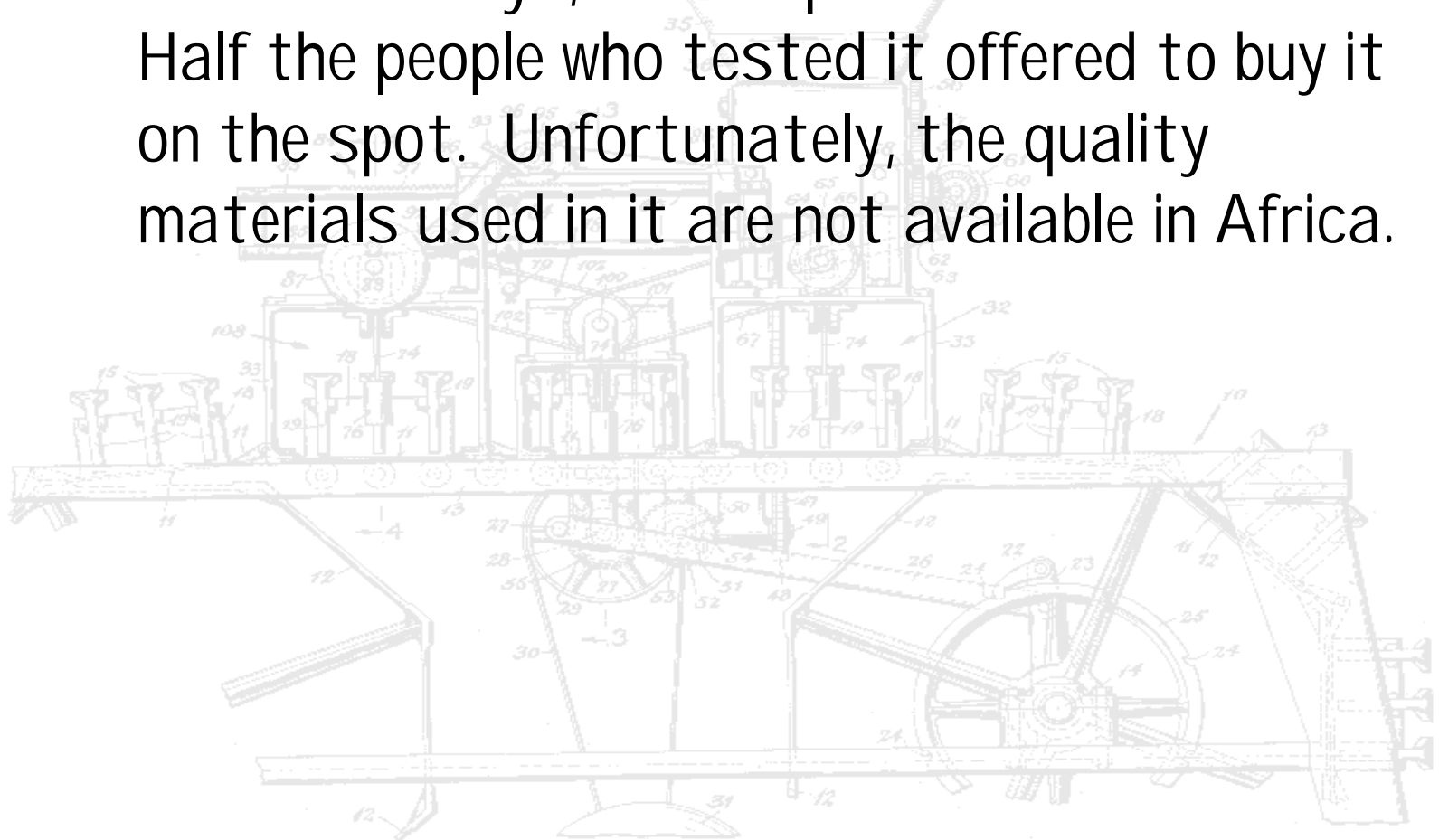
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- Conclusion:
  - Big Boda is solid, useful product
  - Unfortunately it doesn't address the three universal problems faced by Kenyan cyclists:
    - poor brakes on ordinary bikes
    - not geared low enough for hill-climbing
    - poor overall durability (bad bottom brackets, poor tires, soft nuts and bolts, weak forks, bad pedals)
  - Therefore, Big Boda only offers value in niche markets (light, bulky, high-value loads)
  - Better bike is needed, either as 1-piece Big Boda or for extension to be added to.

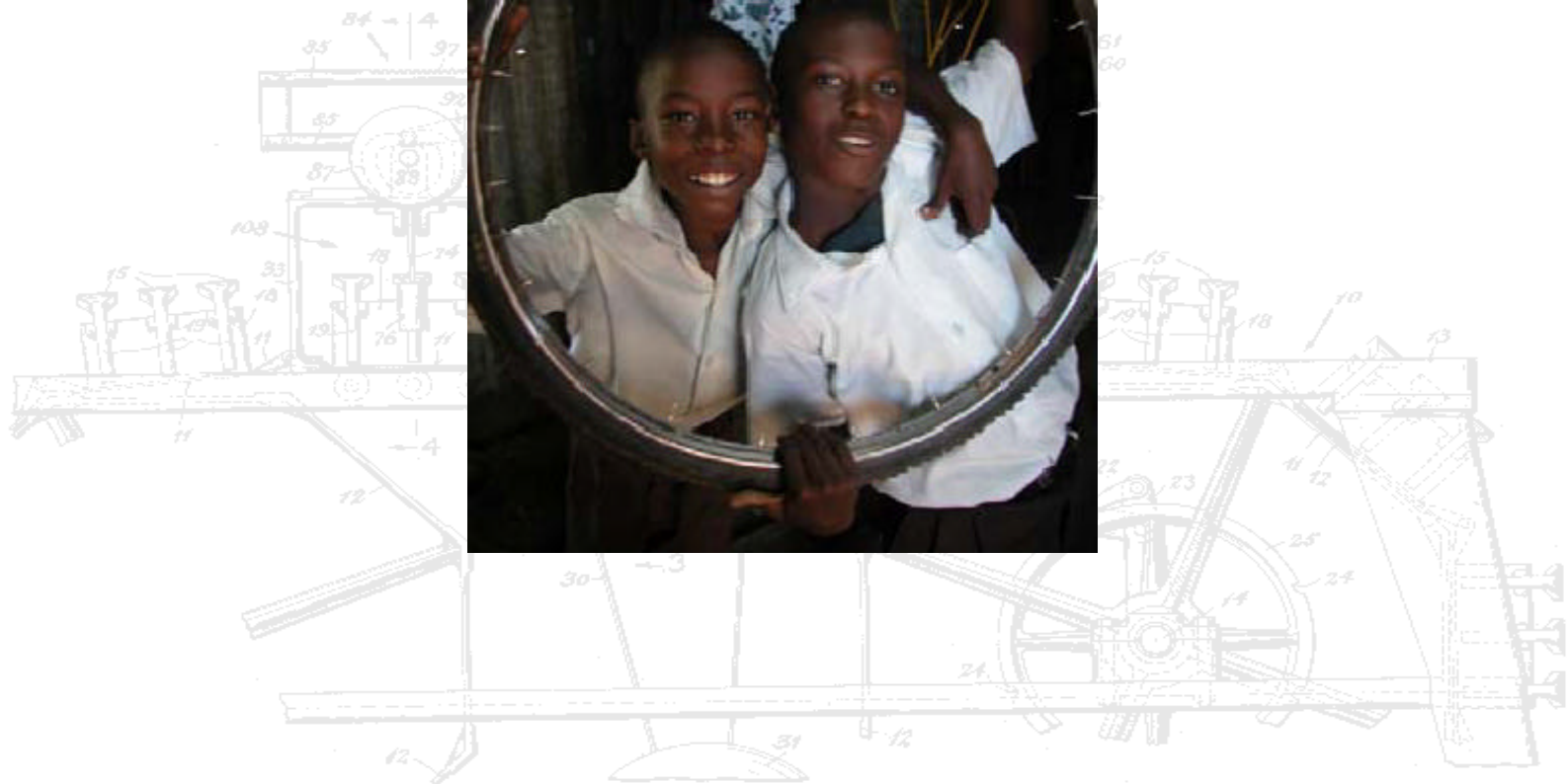
# Manufacturing for other 90%

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- Worldbike
  - A prototype one-piece Big Boda bike was tested in Kenya, and response was fantastic. Half the people who tested it offered to buy it on the spot. Unfortunately, the quality materials used in it are not available in Africa.















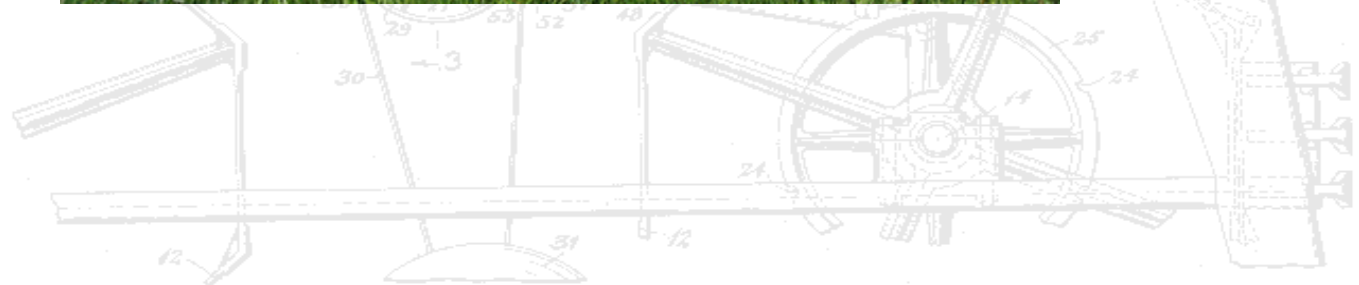
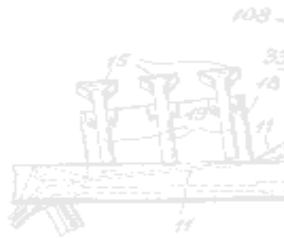












# The PlayPump

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<http://www.youtube.com/watch?v=qjgcHOWcWGE>

# Vil Iager Sun Oven

- <http://www.sunoven.com/assembly.asp>



# So how to bridge the divide?

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- Manufacturing is the basis of most economic activity
- Economic activity is essential to all 100% of the world's population – spread it out!
- An exponentially increasing world population needs exponentially increasing productivity
- Automation is the only way to achieve the efficiencies needed to provide energy, food, goods, and services of the world population
- Use people when appropriate and robots when appropriate
- Watch for unintended consequences
  - displaced local farmers or workers
  - environmental degradation
  - resource depletion
  - defacto subsidies for uneconomical processes

