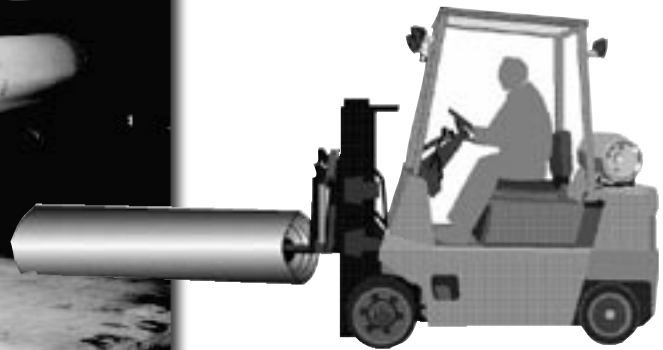


Worksite Modification *Digest*



Forklift with rug pole
See Page 35



Workstation, height-adjustable
See Page 112

See inside for

- Description of worker's disability
- Work setting
- Obstacles
- Modifications
- Cost

Worksite Modification Digest

This digest gives examples of worksite modifications developed by employers, insurers, private consultants, workers, and the Oregon Workers' Compensation Division. It is meant to be a source of ideas for workplace solutions for injured workers with physical limitations.

Oregon employers and workers contribute a "cents per hour" assessment to the Workers' Benefit Fund, managed by the Department of Consumer and Business Services. Money for worksite modification and other return-to-work assistance is available from this fund through the Workers' Compensation Division's Preferred Worker Program and Employer-at-Injury Program.

For more information about worksite modification or other incentives through these programs, contact the Reemployment Assistance Unit, 503-947-7588, 800-445-3948 (toll-free in Oregon); fax 503-947-7581.

Dept. of Consumer & Business Services • Workers' Compensation Division

Preferred Worker Program
350 Winter St. NE
P.O. Box 14480
Salem, OR 97309-0405

Visit us online:
www.oregonpwp.info



In compliance with the Americans with Disabilities Act (ADA), this publication is available in alternative formats. Call the Workers' Compensation Division, 503-947-7627.

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What is worksite modification?

A modification is a change to job tools, equipment, environment or work process that makes a task doable for an injured worker whose physical limitations would otherwise preclude him or her from doing that job. For example, a person with a lower back injury may not be able to lift more than 25 pounds or twist at the waist. Worksite modification for such a worker might be powered lifting equipment or changes to the work station that would eliminate the worker's twisting. Worksite modifications include buying new, used, or custom equipment; making changes to existing equipment or tools; or altering the way the work is done to make the job fit the worker.

Examples of modifications in this digest were developed by the Oregon Workers' Compensation Division, employers, insurers, private consultants, and workers.

Simple low-cost or no-cost worksite modifications

- **Move it closer.** Eliminate repetitive reaching.
- **Get it out of the way.** Position frequently used items in front, to avoid reaching over or around an obstacle and lifting at arm's length.
- **Raise it.** Use wooden blocks, desk risers, monitor risers, cabinets, phone books. Move frequently used files from the bottom cabinet drawers to the top drawers.
- **Lower it.** Re-hang shelves. Move things to a lower shelf.
- **Streamline.** Eliminate a step.
- **Reorder the steps.** Break down the load before moving it instead of moving it first.
- **Maintain the tools.** Sharpen knives. Oil moving parts.
- **Use casters.** Put low-friction casters on equipment to reduce force needed to move it.
- **Change wheels.** Replace small wheels with large wheels to allow equipment to roll easily over grass, pitted floors, or other rough terrain.
- **Cover surfaces.** Cover a rough surface with something hard, such as plastic or steel, to allow materials to slide more easily across the surface.

How to get worksite modification help from Oregon's re-employment assistance programs

Preferred Worker Program

Worksite modification assistance is available for Oregon employers to help return injured workers to work through the Preferred Worker Program.

To be eligible, an employer must meet the following criteria:

- Be an Oregon employer with workers' compensation insurance coverage
- Be the injured worker's employer-at-injury or new employer

For workers to be eligible for the Preferred Worker Program, they must meet the following criteria:

- Be injured on the job in Oregon and have an accepted disabling claim
- Be unable to perform regular job duties because of the injury
- Have permanent disability as a result of the on-the-job injury
- Have documentation from a medical provider of permanent limitations related to the injury

Getting started

If both employer and worker are interested in using worksite-modification benefits, call the Reemployment Assistance Unit for more information about the Preferred Worker Program. The person taking the call will answer your questions about the program. Preferred Worker staff cannot give telephone approval for purchases. Your request for assistance will be assigned to a re-employment consultant who will contact you within a few days and may schedule a visit to the work place.

Re-employment consultants are professionals working for the Workers' Compensation Division who help employers and workers get worksite modification assistance. They approve all worksite modification contracts and purchases and can help select equipment for worksite modifications. They're based in Salem and Medford, and they travel around Oregon meeting with employers and workers.

Remember that any equipment requested in a worksite modification must address the disability caused by the injury. Employers and workers usually contact vendors to research equipment and obtain quotes. Three competitive quotes are required for items that cost over \$2,500 (or \$1,000 for an ergonomic chair). Payment for equipment will be made only after the Workers' Compensation Division has approved a Worksite Modification Agreement.

Employer-at-Injury Program

Worksite modification funds of up to \$2,500 are available through the Employer-at-Injury Program for workers whose employers bring them back to light-duty jobs after injury. Oregon workers' compensation insurance carriers administer this program. For details, call your workers' compensation carrier or the Reemployment Assistance Unit of WCD, 800-445-3948, (toll free in Oregon) or 503-947-7588. Our fax number is 503-947-7581.

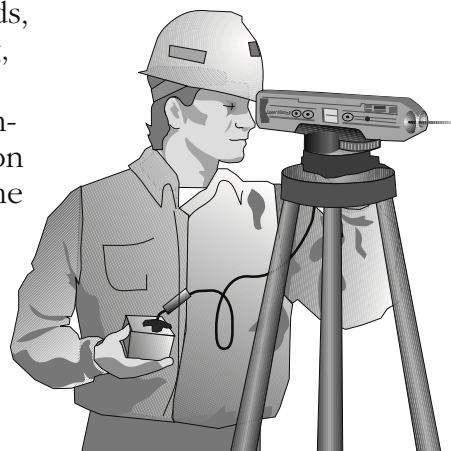
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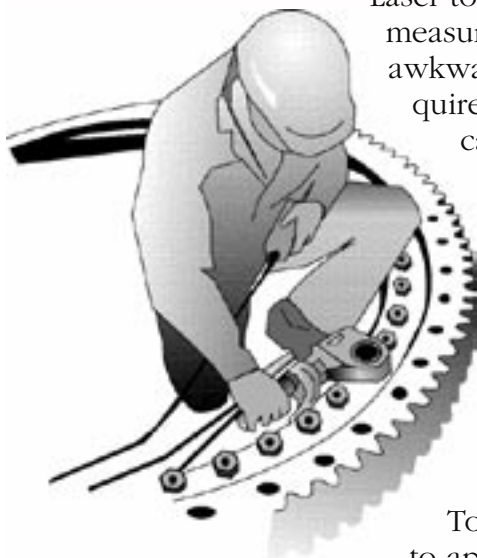
Hand-operated tools

Over time, continuous or repetitive use of hand tools can cause upper-extremity disorders of the hands, wrists, elbows, and shoulders. Forceful gripping, forceful torquing action, hyperextension of the wrists, hyperflexion of the wrists, vibration, hammering with the hands, and any repetitive motion can contribute to these disorders. If trauma to the upper extremities must be reduced or eliminated, there are several approaches you can take.

Repositioning the hands while using tools may relieve symptoms. One option is to reposition the object being worked on. Another approach is to purchase tools with ergonomically designed handles and controls that allow for neutral positioning of the hands and arms.



Laser tools can sometimes enable the worker to measure or take level from a distance and eliminate awkward positioning of the arms and hands required to use the traditional measuring tape or carpenter's level.



Power tools can eliminate the stress of using traditional hand tools. But be aware that power tools can expose the upper extremities to significant vibration. Fortunately, there are a variety of anti-vibration power tools available. There are also special handle wraps to protect workers from power tool vibration.

Torque multiplier wrenches allow workers to apply hundreds of pounds of pressure with relatively little exertion.

Arm-extending pick-up tool

Worker disability

A 52-year-old maintenance supervisor in an apartment complex injured both knees over a period of years by frequently squatting and kneeling. His permanent restrictions include no lifting over 15 pounds, minimal stair climbing, minimal walking, and no squatting or kneeling.

Work setting

The worker has many duties related to the upkeep of buildings and grounds. One of the duties is to pick up trash and litter.

Obstacle

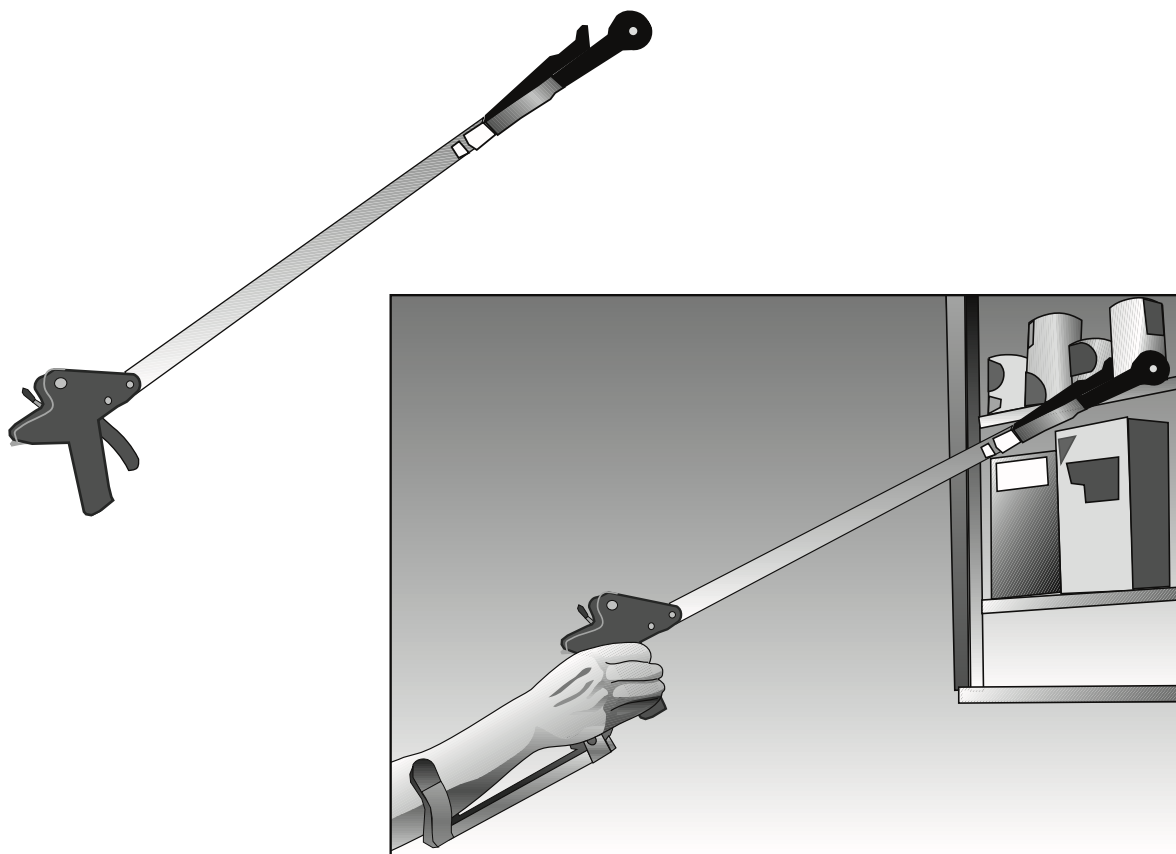
The worker cannot squat or kneel to pick up litter from the grounds and other public areas.

Modification

A reaching pick-up tool is lightweight and 33 inches long (it comes in various lengths). It is trigger-operated and can grip and pick up a variety of items such as wastepaper, cans, nails, and cigarette butts.

Cost of modification

The 33-inch tool costs about \$25, including shipping.



Ergonomic hand tools

Worker disability

A 39-year-old ambulance mechanic injured his shoulder and neck, which required surgery.

Work setting

The worker returned to work for his employer at injury as a wheelchair mechanic and equipment assembler. The job requires tightening and loosening screws and bolts.

Obstacles

The worker is unable to work overhead or do repetitive torquing action with his dominant arm. He has difficulty performing tasks that require raising his injured shoulder.

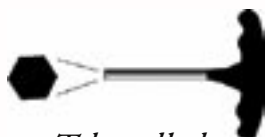
Modifications

An adjustable-height worktable allows the mechanic to raise and lower his work rather than his shoulder.

The worker was also provided with an assortment of power tools and ergonomically designed hand tools that allow him to use his shoulder in a more relaxed position with less physical force. The tools were provided as a worksite modification rather than an obtained employment purchase because the worker's previous hand tools were inadequate to overcome his injury-related obstacles to employment.

Cost of modifications

The adjustable worktable and tools cost about \$5,050; table lift, \$3,812; and ergonomic and power hand tools, \$1,238.



*T-handled
hex key*



*Electric
drill*



*Long-handled
pliers*



*Electric
ratchet*



*Electric
screwdriver*

Laser level

Worker disability

A 57-year-old carpenter sustained a right-rotator-cuff tear while demolishing a wall. After recovery, he had lifting restrictions and couldn't use his right hand above shoulder level.

Work setting

The worker remodeled buildings, built bookshelves, and installed cabinets.

Obstacle

Many of his projects required the use of a carpenter's level. But the worker was no longer able to hold the tool above shoulder level.

Modification

A laser level eliminates holding a level above shoulder height. The laser level provides accurate horizontal and vertical readings.

Cost of modification

The laser level with tripod costs about \$360.

Note

Laser measuring tools are also available and can be useful to people who can't use measuring tapes and other standard tools because of injury-caused physical limitations. Prices range from \$60 to \$900, depending on features.



Wrench — anti-vibration, oil pulse

Worker disability

A 44-year-old farm mechanic suffered from tendinitis and had little tolerance for vibration in his upper extremities.

Work setting

The worker had been a farm mechanic for most of his adult life. The work involved using power wrenches that now caused pain even with short periods of use.

Obstacle

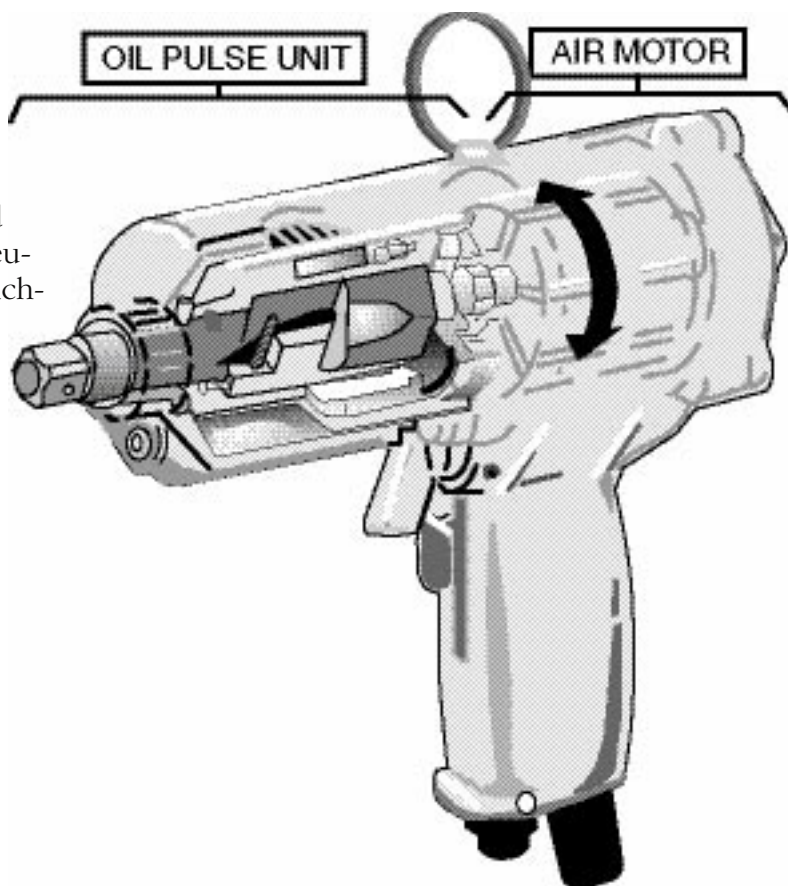
The worker's job required prolonged periods of using power wrenches. The vibration caused by the power wrenches threatened to force the worker to leave this life-long occupation.

Modification

The worker tried a number of anti-vibration tools. The wrenches that worked best for him were pneumatic "oil pulse" wrenches in different sizes. These tools come with comfortable grips that keep the worker's hand in a neutral position.

Cost of modification

"Oil pulse" tools can cost up to \$1,500 each. Total cost of the tools this worker purchased, plus an air compressor and hoses to power them, was about \$9,500. While the expense was considerable, it enabled the worker to continue in his occupation and avoid the cost of retraining for another type of work.



Wrench — torque multiplier, hydraulic

Worker disability

A 31-year-old maintenance mechanic sustained an injury to his back that required surgery. The injury limited his push/pull (torquing) capacity to 100 pounds.

Work setting

As a maintenance mechanic, the worker services heavy equipment at a log and pile-treating yard. The job requires pulling or torquing on wrenches with force exceeding 100 pounds.

Obstacle

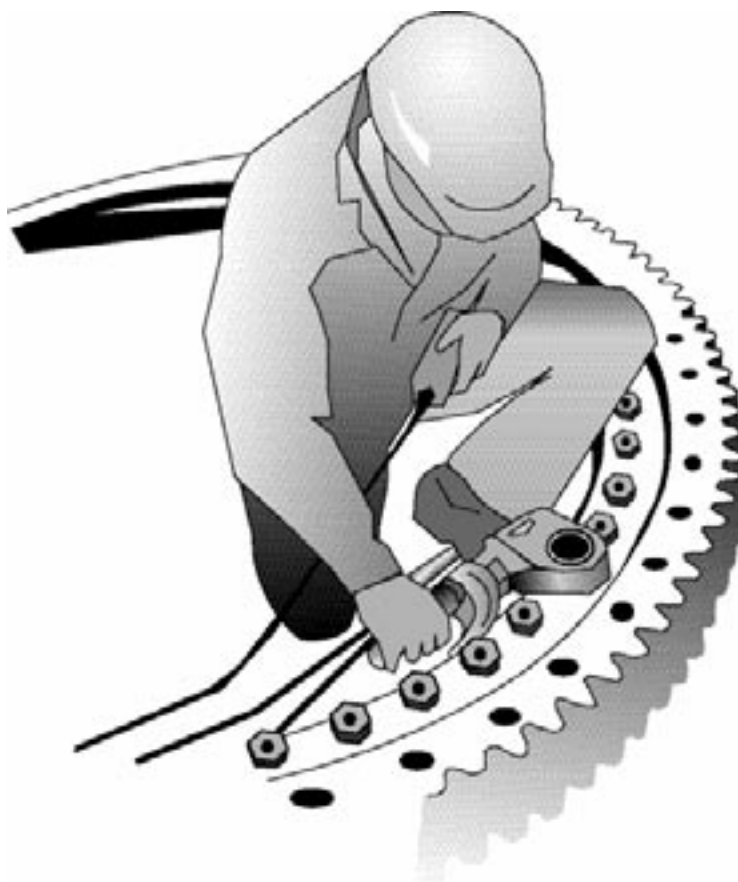
Torquing in excess of 100 pounds.

Modification

A torque multiplier wrench allows the worker to exert 400 to 500 pounds pressure without exceeding 100 pounds input from the worker.

Cost of modification

The torque multiplier wrench costs about \$1,130.



Health-care aids

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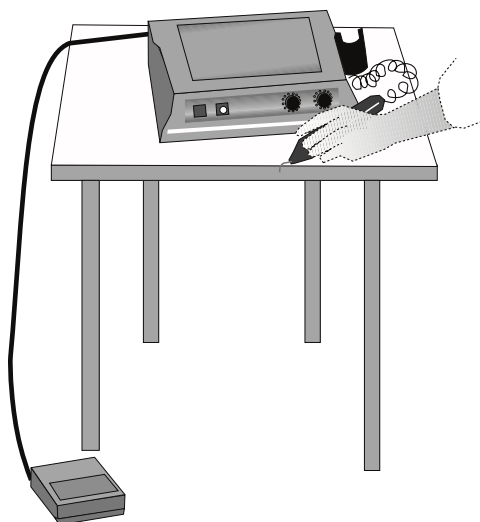
Health-care aids

Health-care occupations are subject to injury; however, there are equipment options available that can prevent injuries and allow workers to return to their chosen professions with reduced risk of re-injury. This digest provides a small sampling of available equipment. Other options can be identified by contacting health-care equipment vendors and professional organizations.

Special features of patient beds and bathing equipment can allow nurses, nurse's aides and other caregivers to perform their work in biomechanically correct postures, making patient lifting and transfers safe for both care-giver and patient. A variety of equipment is available that eliminates dangerous lifting, twisting, and bending, and the best choices for any situation depend upon factors such as these:



- Will the patient be transferred to and/or from a wheelchair? Commode? Bed? Bathtub? Automobile? Gurney? From the floor?
- How much storage room is available for the device? Some take less space than others.
- Is the primary objective to move the patient or to help the patient stand from a seated or lying position?
- How big is the patient (height and weight)?
- Are there any particular challenges in maneuvering the patient (lips on shower-stall entrances, for instance)?
- Is it important for the operator to have one hand free to position or reassure the patient?
- If a lift with a sling is needed, does the sling need to have an "open bottom" so toileting and personal hygiene can be done without removing the sling?



New technology is making many health-care practices more convenient, more hygienic, and less likely to cause cumulative trauma disorders of the upper extremities for practitioners. Examples in this digest include a blood-pressure monitor with automatic cuff inflation and deflation that eliminates manual pumping and an automatic dental scaler (air and ultrasonic models are available) that eliminates continuous forceful pinch-gripping of dental hygienists' instruments.

Blood pressure monitor — automatic

Worker disability

A 48-year-old nursing assistant developed carpal tunnel syndrome of the right wrist.

Work setting

The worker takes patients' blood-pressure readings, which requires using the right hand to squeeze the bulb that inflates the cuff around patients' arms.

Obstacle

Limited strength in the right hand for squeezing.

Modification

The purchase of an automatic digital blood-pressure monitor/pulse monitor, eliminating the need to squeeze the bulb.

Cost of modification

The automatic digital blood-pressure monitor costs about \$250.



Patient lifts

Worker disability

A 44-year-old certified nurse's aide injured his lower back in a lifting incident. His permanent restrictions include a lifting limit of 30 pounds occasionally and preclude repetitive bending, stooping, and twisting.

Work setting

The worker returned to a modified version of his regular work. He was sometimes required to lift patients from a sitting to a standing position or from a sitting or lying position to transfer them to toilet, wheelchair, or chair.

Obstacle

The worker's lifting restrictions precluded manual patient transfers and lifts.

Modification

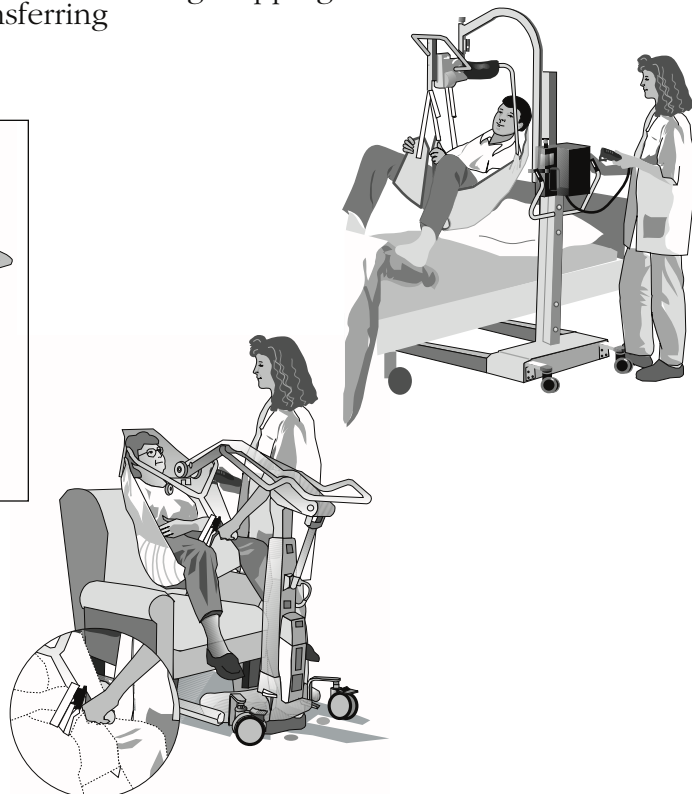
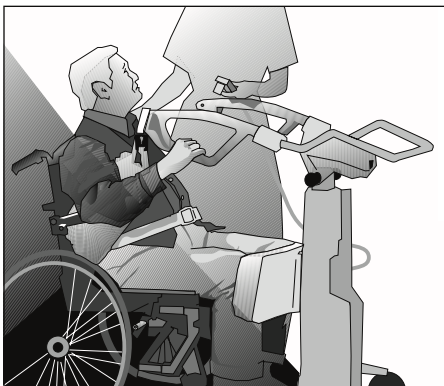
Two types of patient lifts allow the worker to meet the lifting/transferring requirements of his job.

An electric general-purpose lift moves patients from a seated or lying position (even on the floor) and transfers them to a bed, into a wheelchair, onto a toilet, or even into an automobile.

The second type of electric lift, a standing lift, helps the patient from a seated position to a standing position without requiring the worker to exceed his lifting limitations.

Cost of modification

The cost of the general-purpose lift is \$4,300, including shipping. The cost of the standing lift is \$4,200, including shipping.



Patient transfer — hover mattress

Worker disability

A 53-year-old hospital oncology nurse injured her neck, left shoulder, and left knee as she was pulling a patient up in bed. She had permanent restrictions precluding lifting more than 35 pounds and using her left shoulder strenuously.

Work setting

The worker returned to her regular job, which includes frequent transfers of patients from bed to bed, bed to gurney, and bed to wheelchair or commode.

mattress, using an air supply hose. Air escapes from tiny holes on the underside of the mattress. This produces a frictionless layer of air under the mattress, allowing transfer of the patient with little pulling and no lifting.

Obstacle

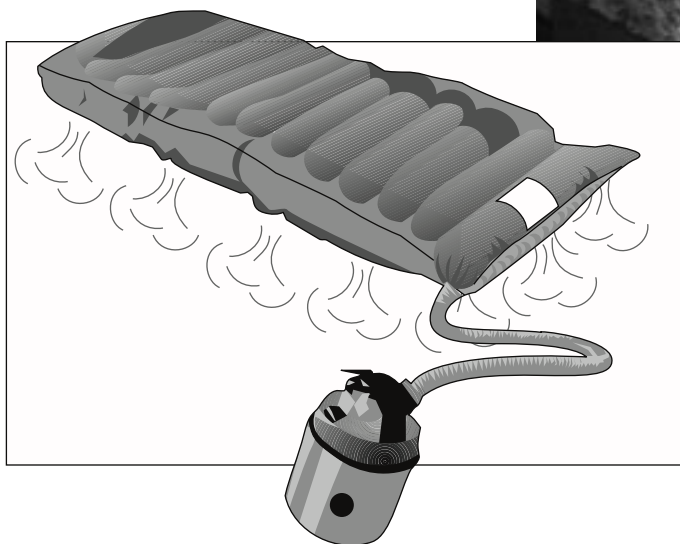
Transferring patients bed to bed or bed to gurney and repositioning patients in bed required lifting and pulling, which was precluded by the worker's restrictions.

Cost of modification

The total cost for 10 mattresses was \$15,500.

Modification

Ten patient-transfer mattresses were purchased for use with all the worker's patients. These mattresses are placed under the patient. The worker inflates the



Pipette machine — automatic

Worker disability

A 37-year-old bagger operator with a fruit and nut company injured her right wrist, then underwent surgery for carpal tunnel. The injury resulted in limited use of the right hand for grasping, squeezing, pushing/pulling, and fine manipulation.

Work setting

The worker was unable to return to her occupation at injury. She returned to work as a receptionist/lab assistant, and she is required to fill test tube vials with a manual spring-loaded syringe, which requires a squeezing motion of the index and middle fingers and thumb or heel of the hand.

Obstacle

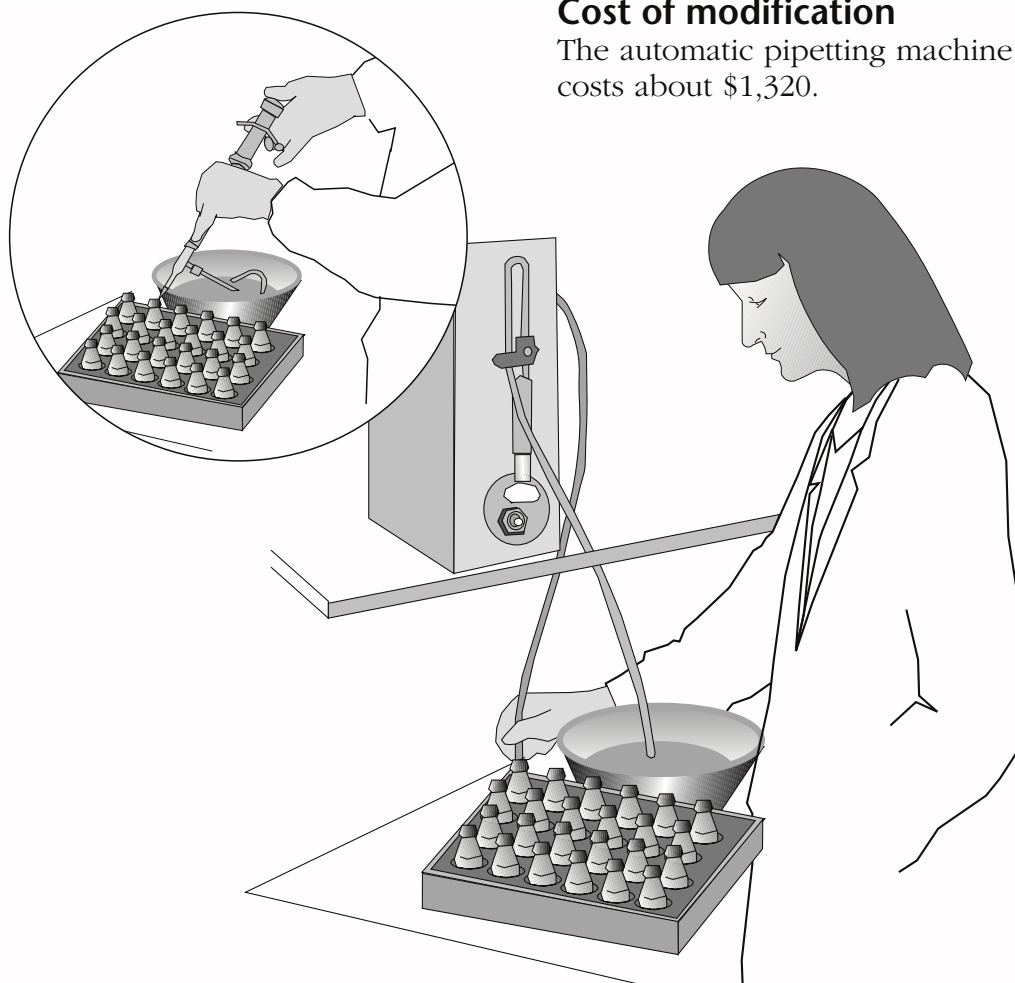
Repetitive squeezing of the right hand while using the spring-loaded syringe.

Modification

A pipetting machine that automatically pumps solutions into the vials eliminates the use of the spring-loaded syringe.

Cost of modification

The automatic pipetting machine costs about \$1,320.



Scale/plaque remover — automatic

Worker disability

A 41-year-old dental hygienist sustained right elbow epicondylitis and right ulnar neuropathy as a result of repetitive hand movements from cleaning patients' teeth. After surgery, her grip and pinch strength were reduced, and it was necessary for her to reduce repetitive hand movements with her dominant right hand.

Work setting

The worker returned to a modified version of her regular work in a private dental office.

Obstacle

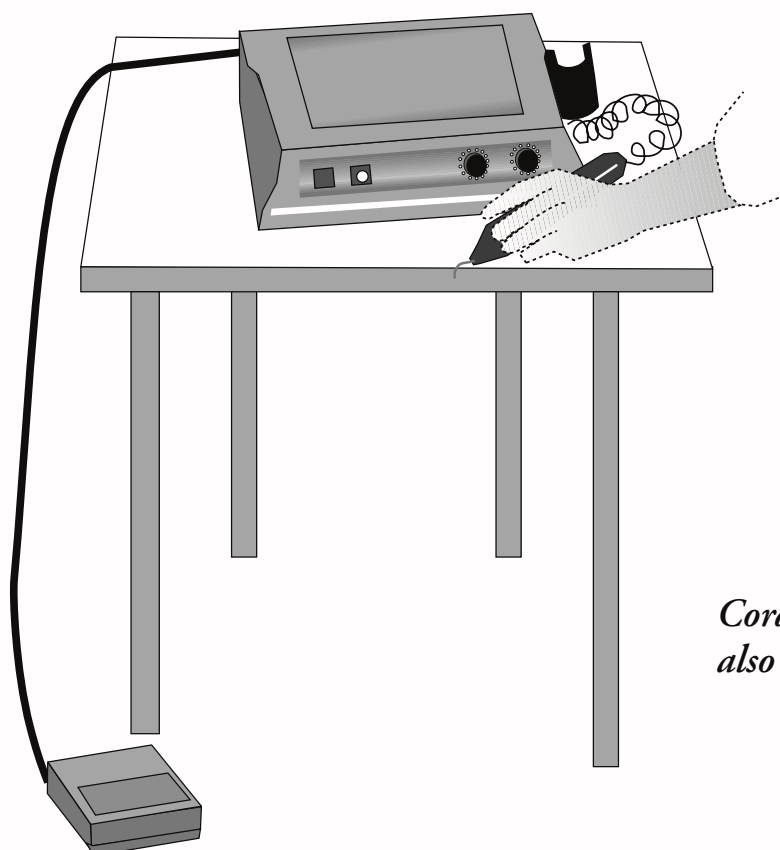
Scaling teeth and removing plaque and stains from teeth normally requires continuous gripping of small hand tools and continuous hand movement.

Modification

A combination automatic scaler and plaque/stain remover was purchased for the worker. It is larger and easier to hold than conventional hygienist tools and greatly reduces hand movement because the tool moves, rather than the hand.

Cost of modification

The combination automatic scaler with tips costs about \$5,700.



Cordless models are also available.

Lifting and positioning aids

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Identifying lifting/moving/positioning equipment solutions

There are many types of equipment that can help workers who have lifting, bending, twisting, carrying, and grasping restrictions. Such equipment can help when workers deal with bulky objects.

Positioners such as lift tables raise loads to a comfortable work height. They can be equipped with roller tops, rotating tops, or tilting mechanisms. Various other industrial manipulators can move loads horizontally, rotationally, and/or vertically. Balancers provide support, control, and triaxial movement and allow workers to guide balanced, “weightless” loads with precision. Articulating jib cranes and bridge cranes provide great flexibility within a limited area. Cranes can also be mounted on trucks to facilitate loading and unloading. (See *Vehicles*.)

Other types of equipment are designed to move materials into or out of a work area into another area. These include various carts, specialized hand trucks and rolling lifts designed to carry small loads as well as pallet jacks, forklifts, and counterbalanced stackers.

One good way to learn about your options is to talk with equipment suppliers. To prepare for that conversation, have answers to the following questions:

- How heavy is the load, and what are its dimensions?
- Will the load be palletized or not? Soft or hard? Regular or irregular in shape? In containers? If so, what type of containers?
- How quickly does the load need to be moved (cycle times for handling and positioning)?
- Where will the load be moved? Will it stay in one room or area? Will it be moved from one room or area to another?
- Over what type of terrain will the load be moved? Cement floor? Pitted cement floor? If so, how big are the “pits”? Over door sill bumps? Paved parking lot? Unpaved parking lot? Carpeted floors? Tiled floors? Up or down ramps? Up or down stairs?
- How much room do you have in which to manipulate? Must the load pass through doors, and if so, how wide is the passage? Will you need to turn the load in a narrow space between racks, or in another small space?
- What is the loading height at origination and destination? Will you pick it up off the floor and deposit it on shelves or racks? Will you pick it up off a shelf and deposit it in a truck?
- If the load must be manually placed on the lifting/moving device from the floor, can it be slid on? Can the worker tip the load and insert the lifting device, as with a hand truck?
- Will the worker ever have to lift the lifting/moving device itself, as in loading it on a truck? How much does it weigh and can the worker safely lift it? Will a lift gate help? Can it be attached to the outside of the truck?
- Will use of a lifting device require shelves or pallet racks?

Besides full-service materials-handling equipment vendors, good resources include industry publications such as *Modern Materials Handling*; the Job Accommodation Network, (800) 526-7234; and ABLEDATA, sponsored by the US Department of Education, (800) 227-0216, www.abledata.com.

Adjustable-height equipment cart

Worker disability

A 55-year-old state trooper injured his lower back and hip and was unable to return to his regular duties. He is now restricted to lifting 35 pounds occasionally and cannot maintain a bent position.

Work setting

The worker's new job includes traveling around the state to train other law enforcement officials in the use of intoxication analyzers. He carries the equipment in the back of a canopied pickup. He must move the analyzers, which weigh 50 pounds each, between the truck and the training rooms. Because the worker is 6 feet 9 inches tall, he would need to bend at the waist in order to push most carts.

into the truck. An extra cart platform was purchased for moving several intoxication analyzers and boxes of training materials.

Cost of modification

The adjustable-height cart costs about \$1,400, plus shipping.

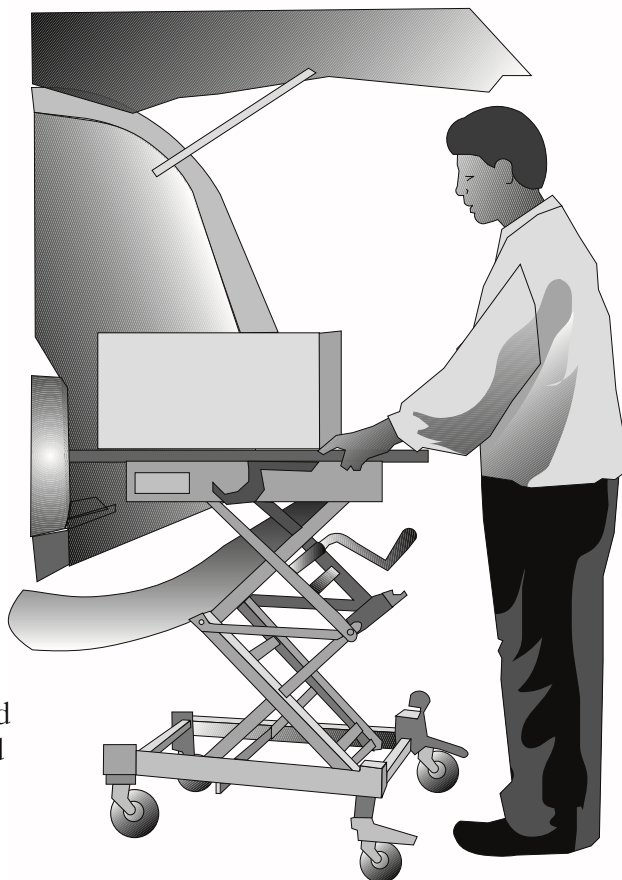
An extra cart platform costs about \$450, plus shipping.

Obstacle

The intoxication analyzers are too heavy for the worker to lift and carry. The use of most carts would require him to bend continuously as he pushes, and many carts would be difficult or impossible for him to lift into the truck.

Modification

An adjustable-height equipment cart has a lift mechanism that adjusts the loading and unloading height of the cart from 20 inches to 40 inches to accommodate the level of the truck bed and the tables where the equipment is to be used. Adjusted to maximum height, the cart can be pushed without continuous bending. The deck of the cart is detachable and rolls onto the surface of the truck bed or the table. The worker can lift the 35-pound undercarriage of the cart



Electric and manual lift carts

Worker disability

A 41-year-old cabinet maker received a neck injury resulting in a discectomy at the C5-6 and C6-7 levels. The injury resulted in limited flexion of the neck.

Work setting

The fabrication and assembly of kitchen and bathroom cabinets as well as furniture such as tables and shelving units. Because most assembly is done on a 15-inch-high workbench, or the floor, the job requires extensive forward bending (flexing) of the neck.

Obstacle

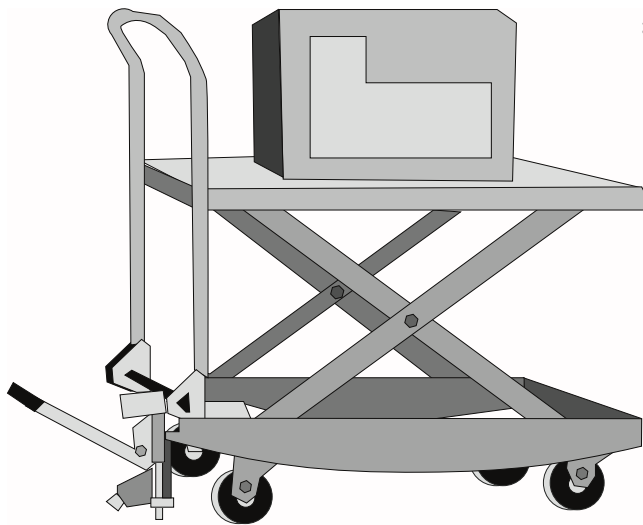
Repetitive flexion of the neck.

Modification

The purchase of a scissors-lift cart allows the worker to adjust his work height to eliminate the repetitive flexion of the neck while assembling and finishing the product.

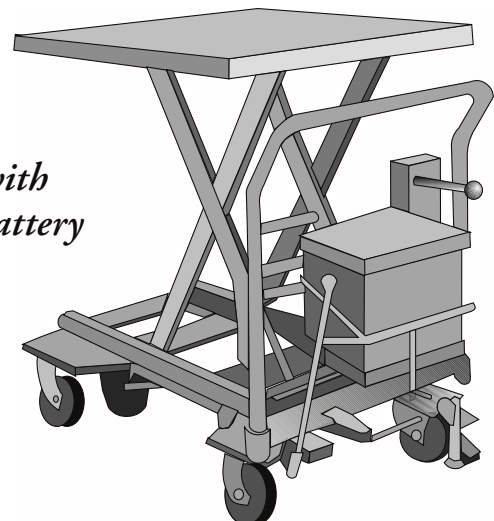
Cost of modification

The electric and manual lift carts cost about \$2,600.



Manual scissor lift

*Also available with
electric power battery
pack*



Leg release cart — portable independent

Worker disability

A 44-year-old roofer injured his back, which resulted in a 25-pound lifting capacity.

Work setting

The worker was unable to return to his occupation at injury. He entered an on-the-job training program to learn office-machine servicing. The job involves driving a station wagon to businesses to transport copiers (40 pounds maximum) to the service site for repairs.

Obstacle

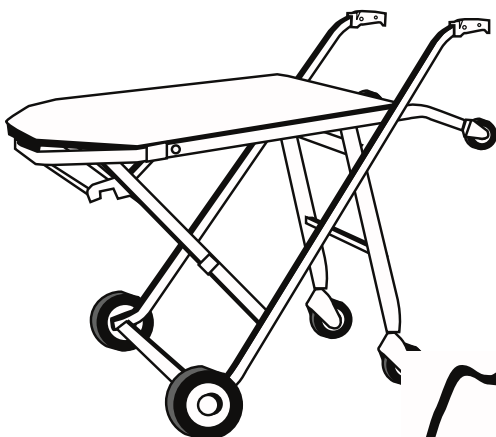
The worker can't lift or carry copiers weighing up to 40 pounds.

Modification

The purchase of a collapsible, independent leg-release cart that can be carried in the station wagon.

Cost of modification

The portable independent leg-release cart costs about \$725.



Load lifter

Worker disability

A 35-year-old sales clerk suffered a left-knee sprain and was permanently restricted to standing/walking for a maximum of three hours a day and standing for no more than one hour at a time. She was restricted to intermittent climbing of stairs and lifting up to 24 pounds on an occasional basis.

Work setting

The worker was offered a new job with her employer-at-injury as a stockroom supervisor. Her duties included maintaining store inventory and supervising stockroom staff.

Obstacles

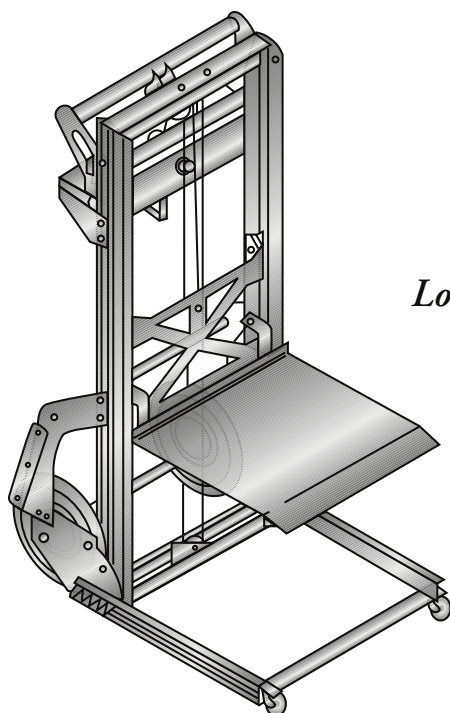
Part of her duties included occasionally lifting and carrying boxes weighing more than 24 pounds and occasionally to frequently climbing a flight of stairs in the stockroom, sometimes while carrying boxes. Performing these tasks would exceed her permanent restrictions.

Modification

The Preferred Worker Program provided an electric telescopic stock picker that allows her access to the upper level of the stockroom without her having to climb stairs. A contractor was hired to fabricate a custom gate and railing that allows the worker to access the upper level directly from the stock picker. A custom step also allows the worker to use the stockpicker from floor level. A load lifter allows the worker to lift and carry boxes and loads weighing more than 24 pounds.

Cost of modification

The cost of the electric stock picker, including shipping, was \$6,261. The load lifter, with shipping, cost \$685. Contractor charges amounted to \$675. Total worksite modification cost was \$7,621.



Load lifter

See also “stock picker” on Page 52

Panel transport cart

Worker disability

A 50-year-old wood-shop teacher sustained a knee injury. He has permanent restrictions from lifting or carrying more than 60 pounds.

Work setting

The worker returned to his regular work but was unable to perform some duties.

Obstacle

The worker is responsible for securing students' unfinished projects in a second-story room with stairway access. He must also retrieve wood panels that weigh 75-100 pounds, depending on the length, from a storage shed and carry them to the instruction area. Once the panels are in the instruction area, he must cut the panels for student projects. Cutting the panels involves lifting and maneuvering the panels onto a table saw.

a horizontal plane so that the panels can be loaded by sliding. The Preferred Worker Program also purchased a panel saw that is vertically mounted on a frame equipped with rollers, allowing the worker to load the panels on the saw platform by sliding and to make the desired cuts without having to lift the panels.

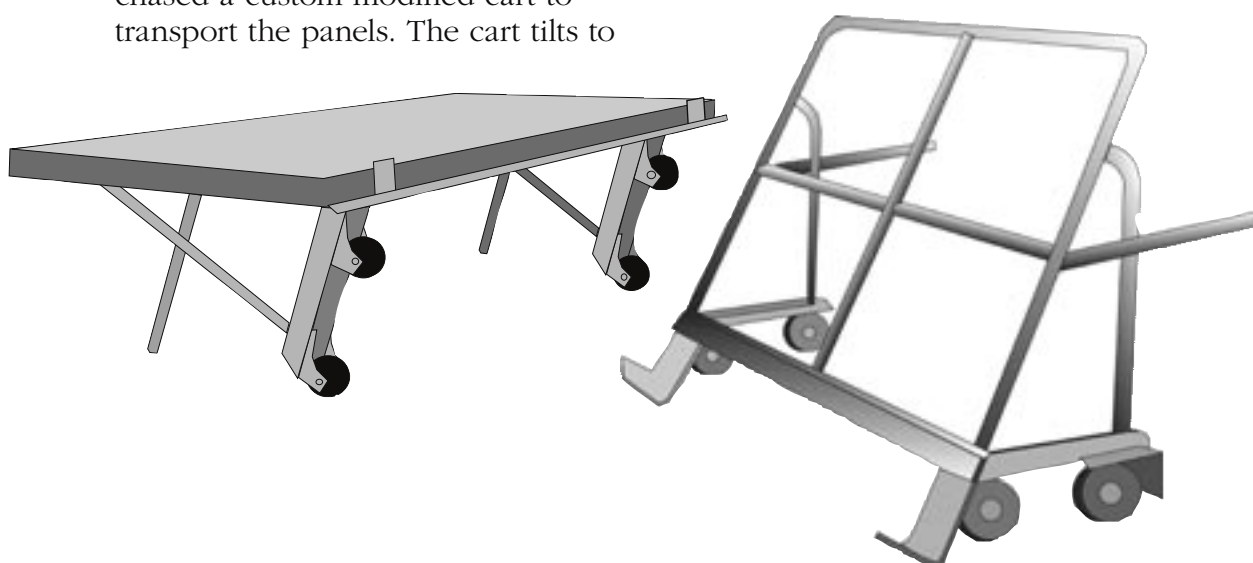
In addition to the featured modification, the employer agreed to re-assign the lifting and carrying of projects to other personnel and students.

Cost of the modification

The panel transport cart costs about \$3,300.

Modifications

The Preferred Worker Program purchased a custom-modified cart to transport the panels. The cart tilts to



Server lift

Worker disability

A computer technician injured his lower back lifting a heavy server from floor level onto a cart.

Work setting

The worker's job duties included setting up and maintaining computer networks. He occasionally needed to lift and move computer equipment weighing 50 to 100 pounds or more.

Obstacle

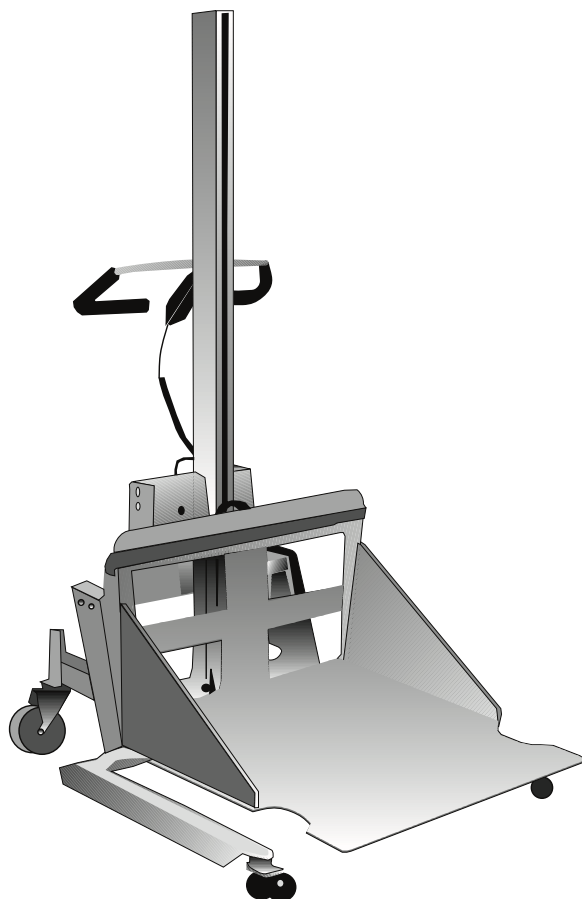
The worker was restricted to lifting and carrying a maximum of 35 pounds occasionally and 20 pounds frequently.

Modification

A "server lift" is a lift-and-carry device that features an electric lift mechanism that accommodates various load weights and lift heights. The sturdy, thin, beveled-edge platform moves all the way to floor level to allow the worker to easily slide equipment from the floor onto the platform.

Cost of modification

The server lift costs about \$6,000.



Small lift

Worker disability

A 24-year-old assembly worker sustained a lower-back injury while handling heavy boxes of supplies. The injury resulted in permanent lifting restrictions of no more than 20 pounds frequently and 35 pounds occasionally.

Work setting

The worker returned to her regular mechanical assembly job where she made pump parts. The assembly work itself did not involve lifting or carrying heavy items. She was required to retrieve parts from the supply area and bring them to the assembly area.

Obstacle

The worker had to bring boxes of small metal parts weighing up to 80 pounds from shelves up to 60 inches from the floor, and position them at the assembly bench. The existing cart for doing this task had a three-inch lip around the carrying platform. The worker had to lift the boxes of parts from the shelves and over the lip of the cart, into the cart. At the assembly bench, she again had to lift the boxes over the lip of the cart and place them on the bench.

Modification

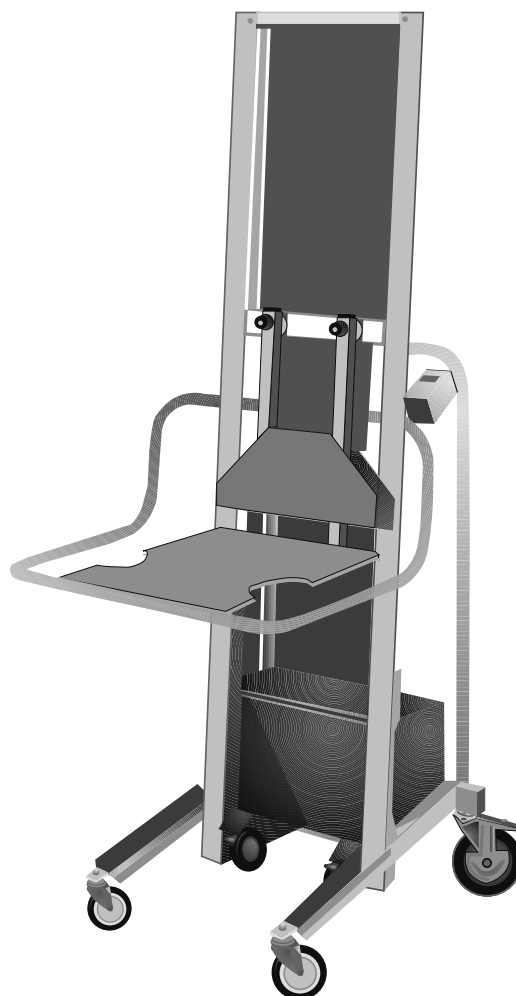
The cart was replaced with a small, battery-powered aluminum lift that would lift a load up to 200 pounds as high as 65 inches. It was equipped with a platform onto which the boxes were slid from the shelf and from which they were slid to the bench, after the employee adjusted the height of the load. The mechanical lift eliminated all manual lifting of the boxes and other supplies.

Cost of modification

The small lift costs \$5,100.

Note

These carts come in a range of lifting capacities and lift heights. They can be equipped for rotating, gripping, tipping, and for carrying out other functions such as weighing and counting small items.



Video cart and custom shelving

Worker disability

A 38-year-old VCR and tape rental clerk injured her sternum, which resulted in her inability to lift and carry more than 20 pounds and reach overhead.

Work setting

The job requires the worker to repetitively reach overhead to pull out rental video tapes from a storage area and lift and carry 19-inch television sets and video tape recorders to customers.

Modifications

Fabrication and installation of eye-level shelving on which to store video tapes eliminated reaching overhead. The construction of a four-level cart to hold TVs and VCRs eliminated lifting and carrying.

Obstacles

Repetitive reaching overhead for video tapes, lifting and carrying TVs weighing over 40 pounds, and lifting and carrying VCRs weighing more than 20 pounds.

Cost of modifications

The custom shelving costs about \$1,200.



Wheelbarrow — power cart

Worker disability

A 26-year-old construction worker injured his right knee and, after multiple surgeries, could stand and walk for only three hours per shift; handle loads of only 30 pounds occasionally; and twist, squat, or climb occasionally.

Work setting

In his new job as a concrete specialist, the worker's primary duty was driving a truck; however, he was also required to move materials at the worksite using a wheelbarrow.

Obstacle

A loaded wheelbarrow required the worker to lift, push, and pull weights considerably beyond his 30-pound limit.

Modification

A power carrier was purchased to allow the worker to move loads of materials at construction sites. It has an 800-pound capacity.

Cost of modification

The power carrier costs about \$1,500 with all-terrain tires.

Note

Other types of power carriers have track steering, adjustable side rails, and tilt and lift cargo beds. They cost as much as \$5,700.



Counterbalance stacker with barrel attachment

Worker disability

A 32-year-old truck driver/plant mechanic injured his back in an automobile accident. The injury limited his lifting and carrying ability to 100 pounds.

Work setting

The worker's job is driving tank trucks to the distribution center and moving 55-gallon drums of petroleum products, stacked two high, that weigh more than 500 pounds.

Obstacle

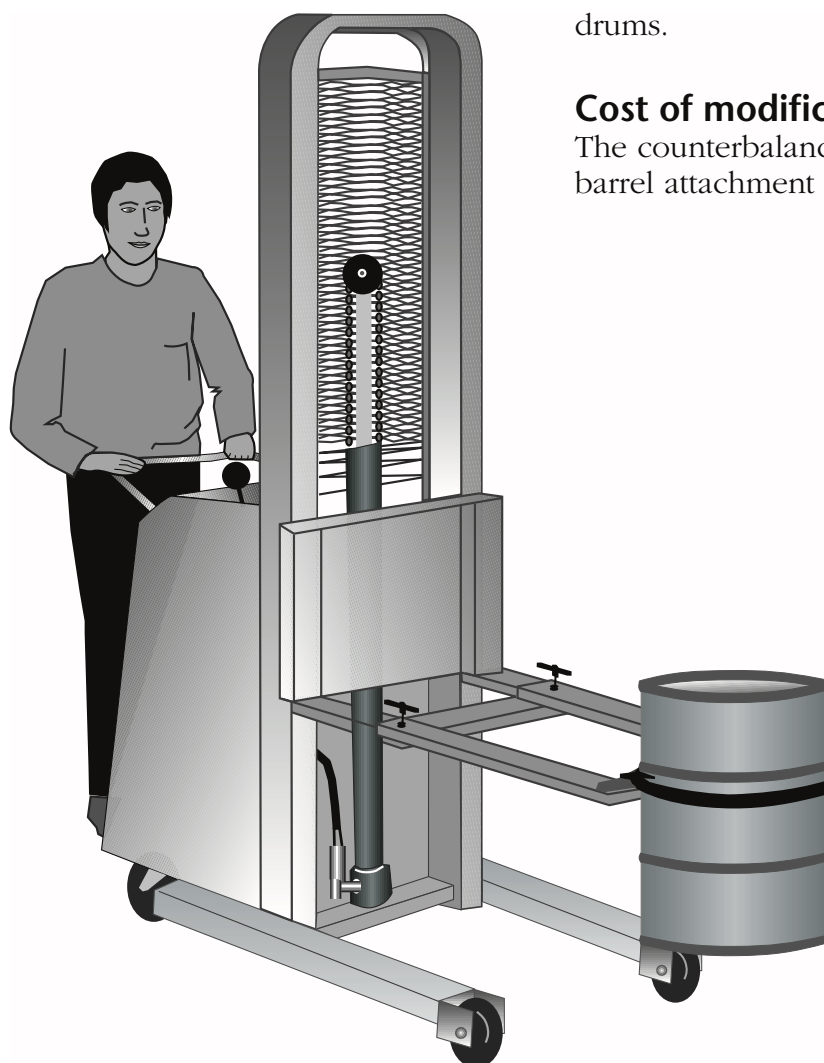
Moving 55-gallon drums.

Modification

The purchase of a counterbalance stacker and a barrel-lift attachment to allow the worker to move 55-gallon drums.

Cost of modification

The counterbalance stacker with barrel attachment costs about \$5,887.



Extenders

Worker disability

A 28-year-old man employed as a planer chain puller injured his back, which resulted in a laminectomy. The worker was limited to lifting and carrying less than 50 pounds.

Work setting

The worker was unable to return to his occupation at injury. He returned to work as a cement-brick-making-machine operator, which generally requires duties that exceed the worker's physical capabilities. Therefore, modification of the workstation is necessary to permit work at a normal, or near normal, level of productivity.

Obstacles

A brick-making-machine operator maintains and operates machinery used to manufacture cement fire bricks. There are three particular activities associated with this job that exceed the worker's physical capabilities:

Moving buckets (65 pounds) of excess brick material 30 feet; moving brick molds weighing up to 250 pounds – usually requiring two workers to lift them six feet; and moving a 125-pound metal hopper.

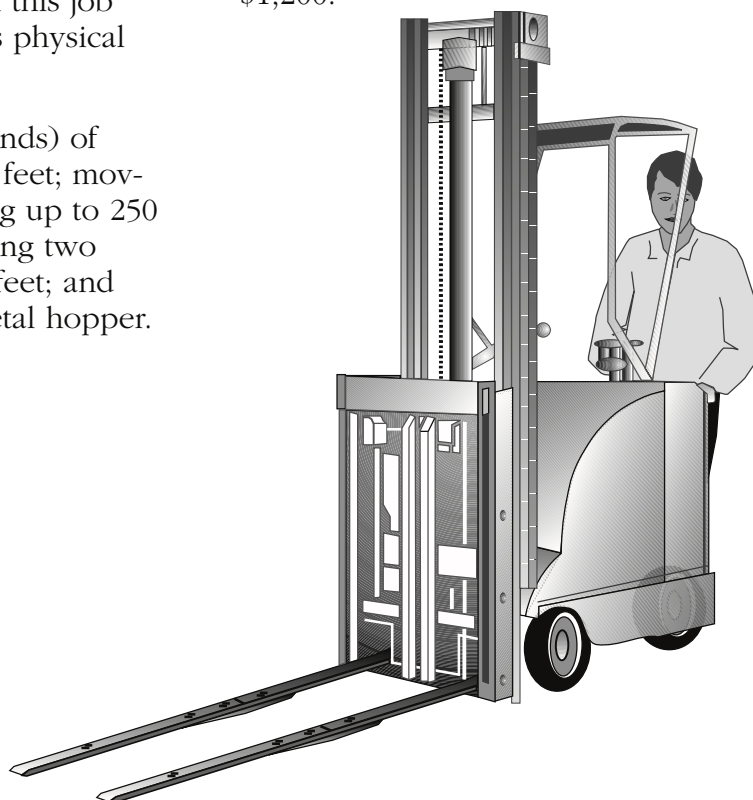
Modifications

A hand truck was purchased so that the worker needs only to slide the hand truck under the buckets to move them.

To facilitate the movement of the brick molds and metal hopper, the purchase of special forklift extenders (super-lift) was needed because the standard equipment was too short to reach the items and lift them in a safe and stable manner.

Cost of modifications

The forklift extender costs about \$1,200.



Lift truck

Worker disability

A 44-year-old warehouseman injured his back, which resulted in reduced ability to walk and bend repetitively.

Work setting

The job requires the worker to sort damaged and returned goods from a pallet at floor level and place them in 48-inch-high cardboard bins. Once the bins are filled, the worker uses a manual pallet jack to move bins.

Modification

A lift truck was purchased so the worker would not be required to bend down to sort damaged goods, allowing the worker to sort goods at a comfortable height. The lift truck also allows the worker to move the bins while sitting.

Obstacles

Walking 50 percent of the day and repetitive standing and bending.

Cost of modification

The lift truck costs about \$15,000 (used).

Lift truck



Rug-pole attachment

Worker disability

A 34-year-old carpet and vinyl installer herniated a lumbar disk while installing carpet. After the injury, he was permanently limited to lifting and carrying 25 pounds and was able to push or pull a maximum of 100 pounds.

Work setting

At the flooring warehouse, the worker had to handle large, heavy rolls of carpet and vinyl with help from coworkers. At customer locations, the worker's duties included moving heavy appliances to install floor coverings.

Obstacle

The worker could no longer help move rolls of carpet and vinyl because of his lifting restrictions. He could not move appliances as necessary to install floor coverings.

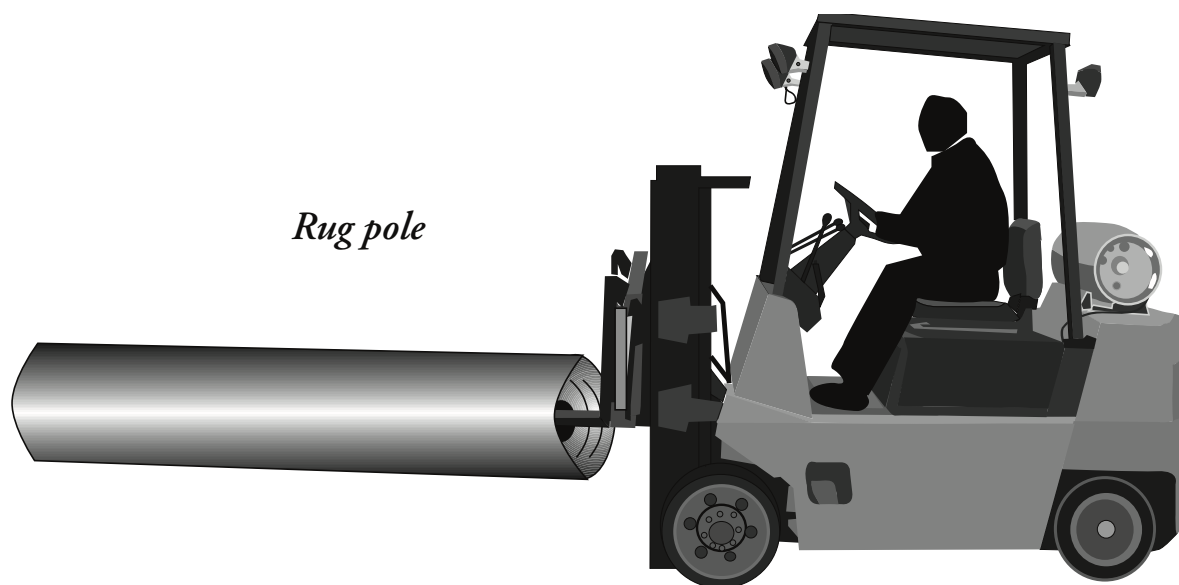
Modification

At the warehouse, a forklift was outfitted with a "rug pole" on which rolls of carpet and vinyl can be lifted and moved.

An "airsled," which raises appliances on air cushions to allow easy movement of appliances over porous and non-porous surfaces, was provided.

Cost of modification

The forklift and rug pole cost about \$18,125. The airsled costs about \$600.



Rug pole

See also "airsled" on Page 43

Vacuum-lift attachment

Worker disability

A 40-year-old punch-press operator fell and fractured his left wrist. His residual carpal tunnel syndrome resulted in left hand weakness and reduced the range of motion in his left wrist. He was restricted from heavy lifting.

Work setting

The worker found a new job as a door and window installer. He worked on a large construction site where his employer installed plate-glass windows and metal doors.

Obstacle

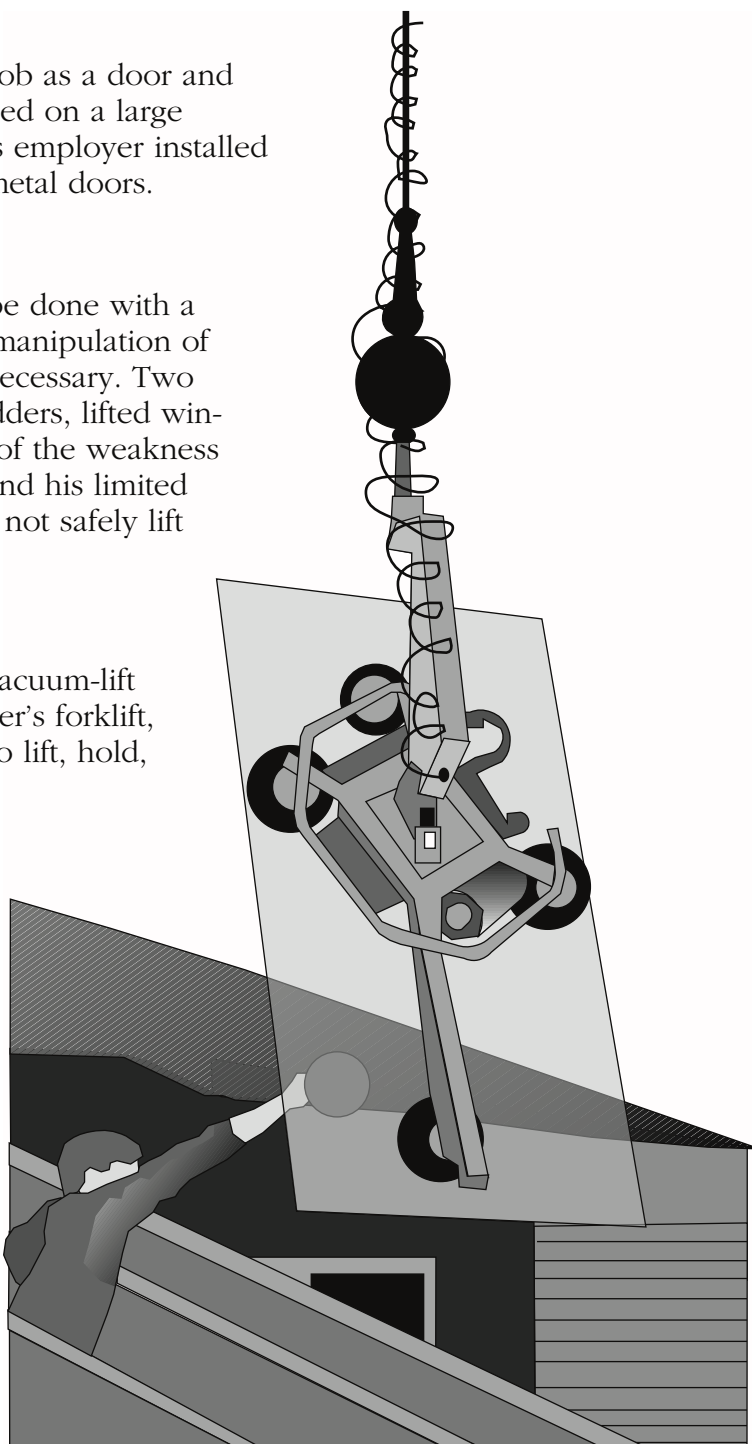
Much of the lifting could be done with a forklift; however, manual manipulation of windows was frequently necessary. Two workers, sometimes on ladders, lifted windows into place. Because of the weakness in the worker's left hand and his limited range of motion, he could not safely lift the windows into place.

Modification

The program provided a vacuum-lift attachment for the employer's forklift, which allows the worker to lift, hold, and position plate glass.

Cost of modification

The vacuum-lift attachment costs about \$3,200.



Appliance hand truck

Worker disability

A 51-year-old experimental biological technician sustained a disabling back injury when he fell five feet from a trailer, landing on his back. As a result of the injury, the worker can lift and carry up to 45 pounds only occasionally.

Work setting

The worker was unable to return to his occupation at injury. He returned to work as a laborer in a physical education department, which required occasional lifting of up to 75 pounds.

Obstacles

1. Movement of equipment weighing more than 45 pounds up and down stairs.
2. Unloading and stacking archery targets weighing more than 60 pounds from shelves up to eight feet high.

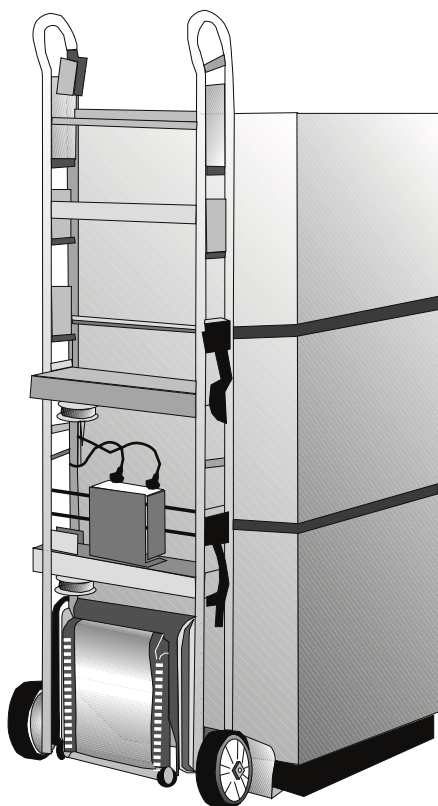
Modifications

To move equipment up and down stairs, a powered appliance hand truck was purchased.

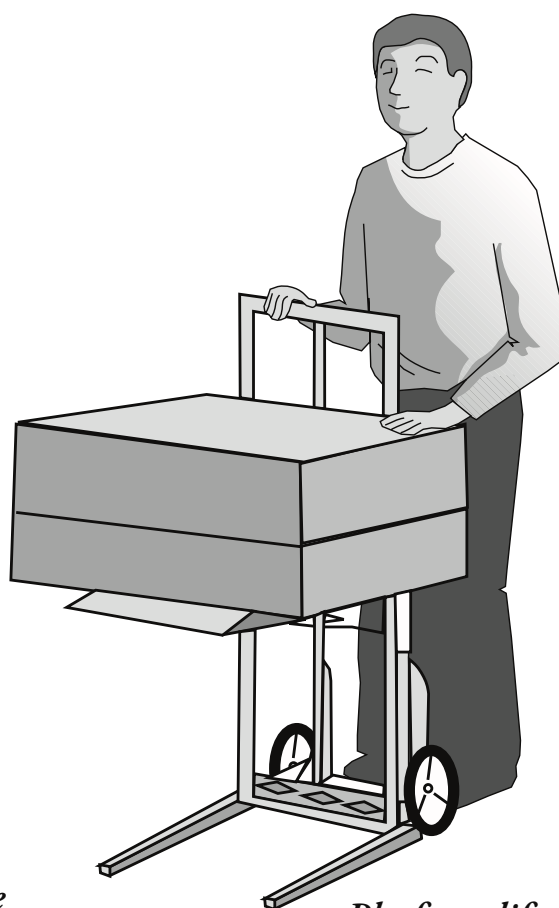
To unload and stack archery targets up to eight feet high, a powered platform lift was purchased.

Cost of modifications

The appliance hand truck costs \$2,100.



*Appliance
hand truck*



Platform lift

Hand truck with brake

Worker disability

A 28-year-old freight delivery driver sustained a left knee injury that resulted in permanent lifting, carrying, pushing, and pulling restrictions.

Work setting

The worker returned to modified regular work, which involves moving a variety of items, including heavy appliances and pallet loads of various materials. For these large items, he uses an electric pallet jack to eliminate the out-of-restriction push and

pull requirements and a liftgate on his truck to deliver items to places without loading docks.

Obstacle

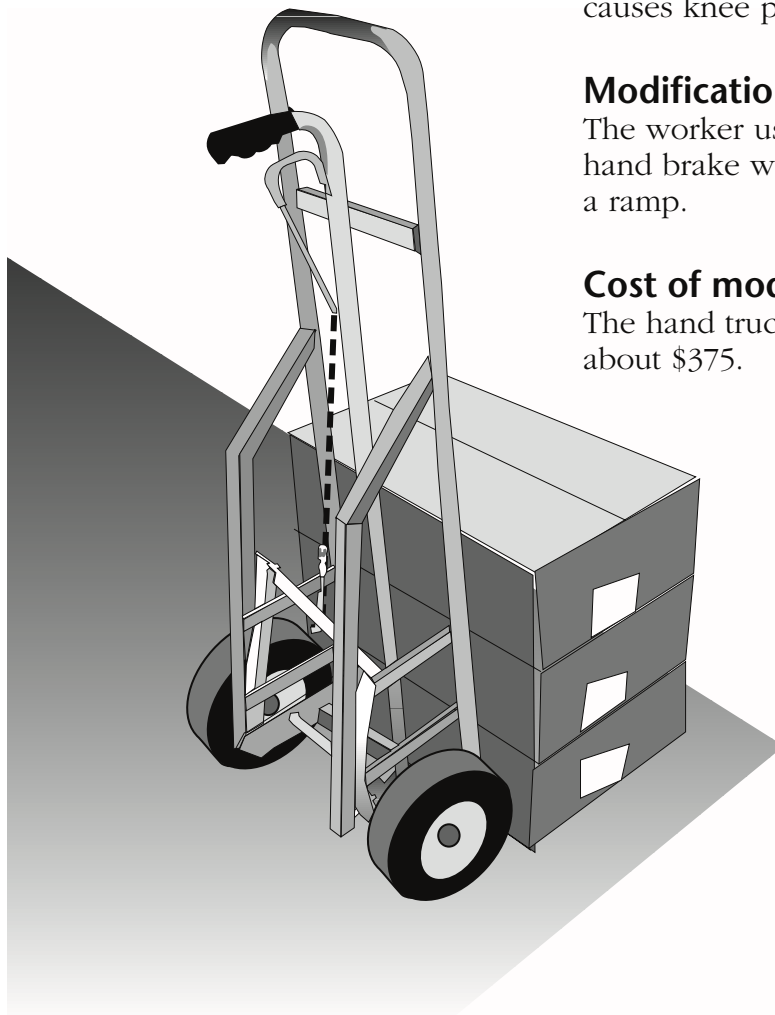
A few delivery sites require the worker to move relatively small loads down ramps on a hand truck. Taking the loaded hand truck down a ramp strains the worker's injured knee and causes knee pain.

Modification

The worker uses a hand truck with a hand brake while taking loads down a ramp.

Cost of modification

The hand truck with brake costs about \$375.



Jack — motorized

Worker disability

A 42-year-old shipping clerk at a catalog distributor injured her low back. After surgery and recovery, she had permanent restrictions from lifting, carrying, pushing, and pulling more than 50 pounds.

Work setting

The worker was unable to return to her regular job, but was offered a receiving clerk position by her employer-at-injury. Job duties included unloading trucks using a pallet jack and moving pallet loads of materials to various parts of the warehouse. This job required little manual lifting and could be modified to allow the worker to do the job within her restrictions.

Obstacle

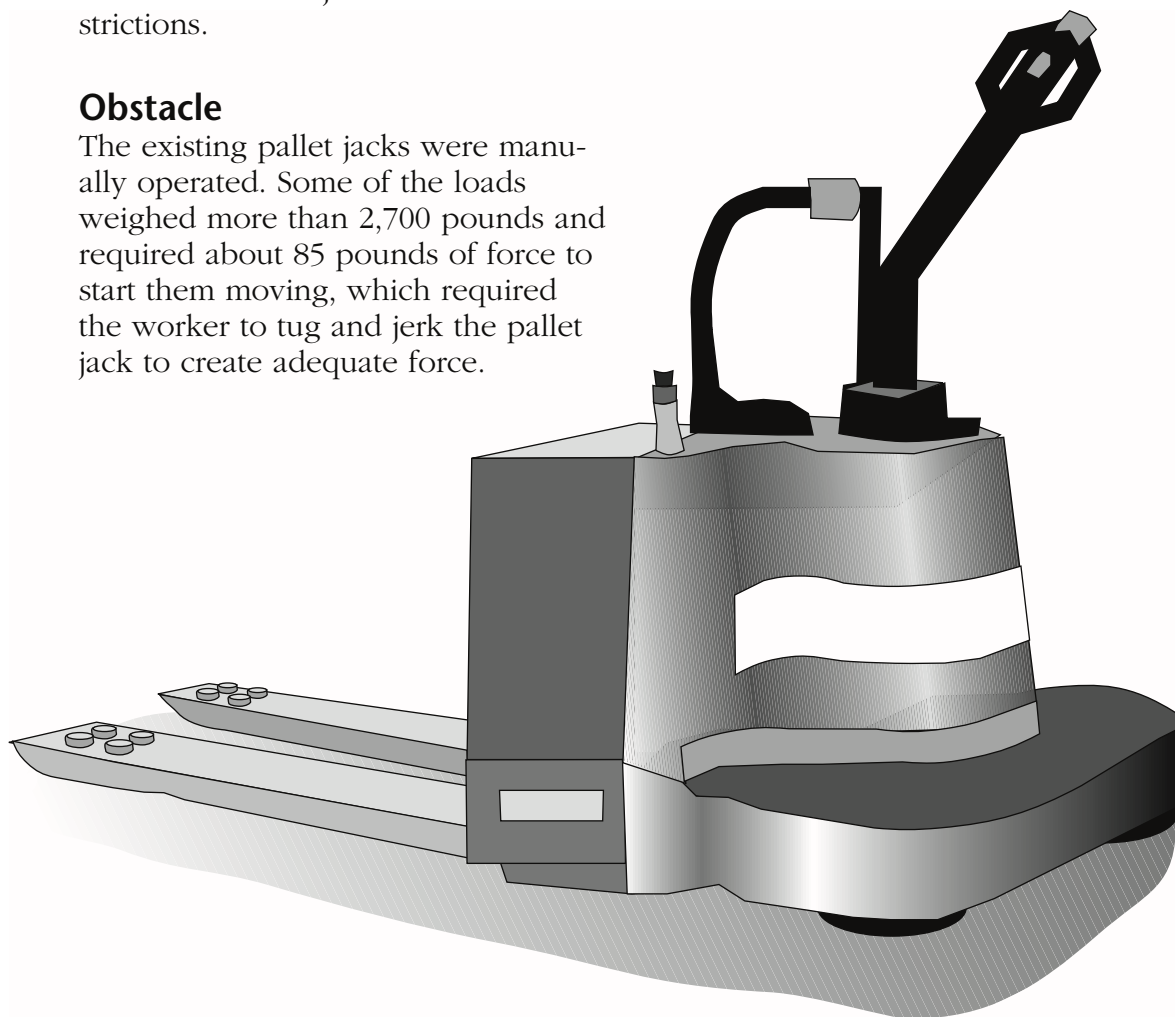
The existing pallet jacks were manually operated. Some of the loads weighed more than 2,700 pounds and required about 85 pounds of force to start them moving, which required the worker to tug and jerk the pallet jack to create adequate force.

Modification

A motorized pallet jack allowed the worker to do her job and eliminated the tugging, jerking, and excessive force necessary with a manual pallet jack.

Cost of modification

The motorized pallet jack costs about \$3,900.



Jack — variable-height

Worker disability

A 28-year-old tree planter injured his left knee in a motor-vehicle accident. Following surgery, the worker could not perform job duties requiring bending of the knee.

Work setting

The worker was placed with a new employer working as a furniture assembler. The job requires feeding lumber onto a table saw from a pallet. It also requires rubbing finishing materials on the undersides of oak furniture.

Obstacle

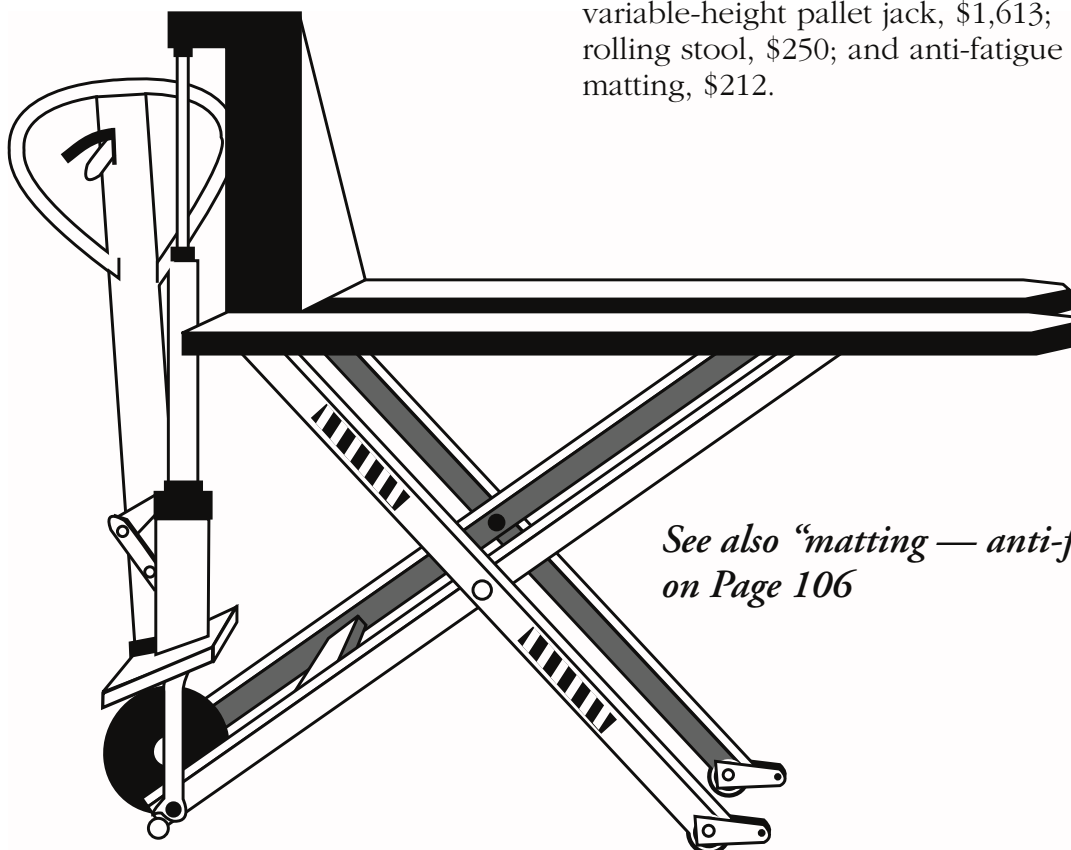
The worker is unable to bend at the knee to retrieve lumber from the pallet or to get underneath the furniture to finish it.

Modifications

A variable-height pallet jack was purchased to move the pallets of lumber around the factory. The worker raises the pallet so the materials are at saw height, eliminating bending for this portion of the job. In addition, the employer purchased a small rolling stool for the worker to sit on while finishing the undersides of furniture. The worker was also provided with anti-fatigue matting.

Cost of modifications

The modifications cost about \$2,000; variable-height pallet jack, \$1,613; rolling stool, \$250; and anti-fatigue matting, \$212.



*See also “matting — anti-fatigue”
on Page 106*

Positioner — pallet unitizer

Worker disability

A 44-year-old warehouseman sustained a lower-back injury resulting in an inability to perform repetitive bending.

Work setting

Unloading cartons from a 27-inch-high conveyor system to a pallet at floor level.

Obstacle

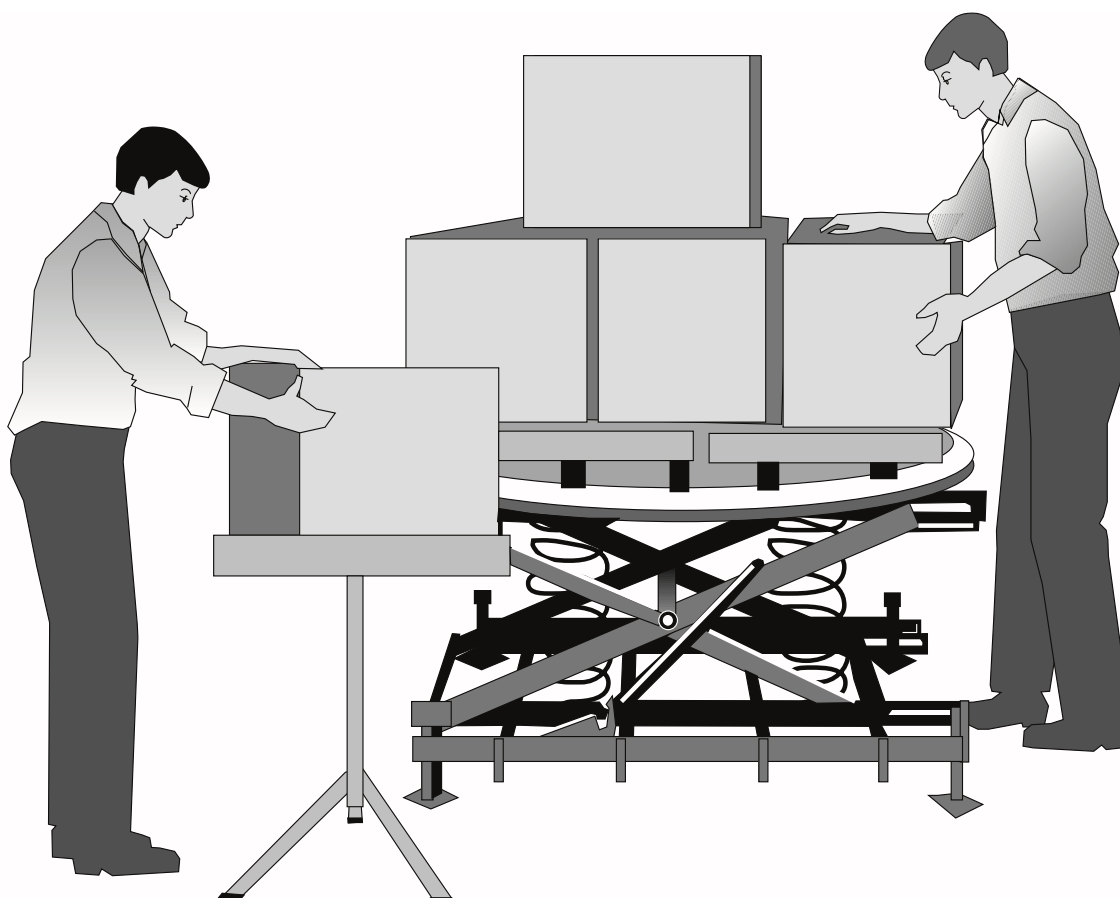
Repetitive bending while loading pallets.

Modification

The purchase of a manual pallet unitizer virtually eliminates, because the load height adjusts automatically. The unit rotates 360 degrees, eliminating most of the requirements for walking and reaching.

Cost of modification

The pallet unitizer costs \$1,500.



Puller — scissor-action

Worker disability

A 39-year-old warehouse worker strained his lower back, resulting in a permanent lifting and carrying limit of 50 pounds.

Work setting

The employer is a farm supply store. The worker must lift and carry 85-pound bales of hay and load rolls of wire fencing weighing 150-200 pounds. The dock at the employer's loading gate does not allow trucks to back up all the way to the door. The worker must carry merchandise from pallets inside delivery trucks into the store.

Obstacle

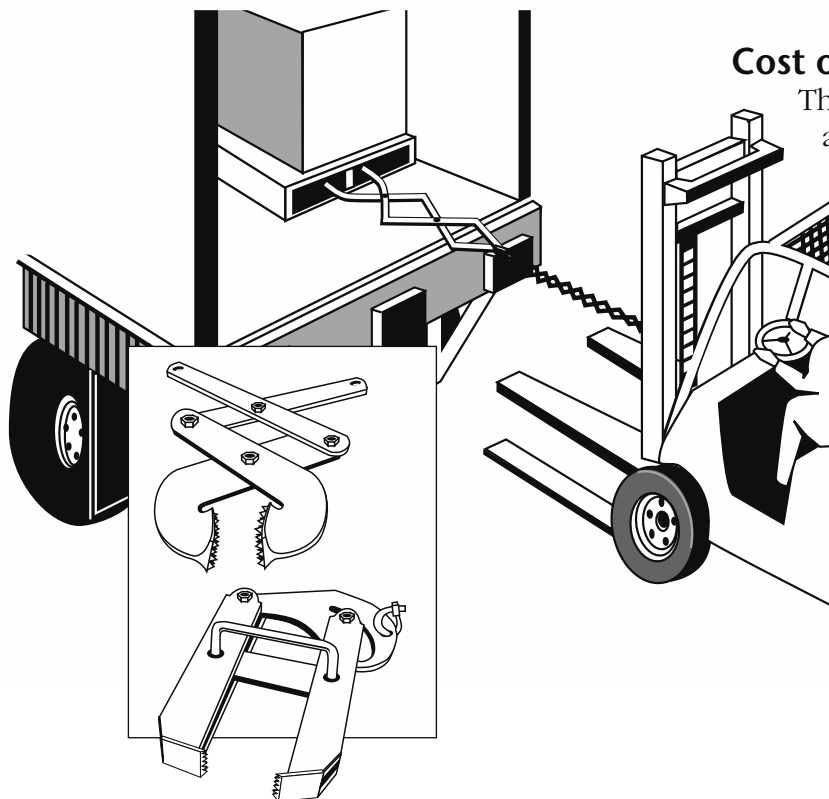
The worker was no longer able to lift and carry over 50 pounds.

Modifications

Part of the dock was removed to allow delivery trucks to back up closer to the door. However, because the dock was not level with the door, a forklift with a scissor-action pallet puller was purchased. The pallet puller, attached by a chain to the forklift, is carried into the back of the truck where it is attached to pallets. The forklift backs up and pulls the pallets to the door of the truck. The pallets are unloaded with a motorized pallet jack. The worker no longer needs to carry the heavy merchandise from the back of the truck into the warehouse.

Cost of modifications

The modifications cost about \$9,534; forklift with pallet puller, \$6,800; and motorized hand pallet truck, \$2,734.



Airsled

Worker disability

A 34-year-old carpet and vinyl installer herniated a lumbar disk while installing carpet. After the injury, he was permanently limited to lifting and carrying 25 pounds and was able to push or pull a maximum of 100 pounds.

Work setting

At the flooring warehouse, the worker had to handle large, heavy rolls of carpet and vinyl with help from coworkers. At customer locations, the worker's duties included moving heavy appliances to install floor coverings.

Obstacle

The worker could no longer help move rolls of carpet and vinyl because of his lifting restrictions. He could not move appliances as necessary to install floor coverings.

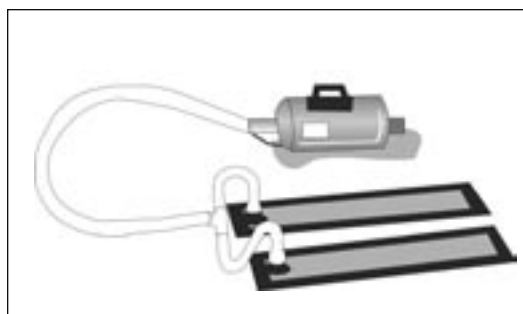
Modification

At the warehouse, a forklift was outfitted with a "rug pole" on which rolls of carpet and vinyl can be lifted and moved.

An "airsled," which raises appliances on air cushions to allow easy movement of appliances over porous and non-porous surfaces, was provided.

Cost of modification

The forklift and rug pole cost about \$18,125. The airsled costs about \$600.



See also "rug pole" on Page 35

Bleacher opener/closer

Worker disability

A 55-year-old school janitor injured his left knee, which left him with residual capacities to lift 30 pounds occasionally, push or pull 65 pounds occasionally, and squat or climb occasionally. He was no longer able to crawl.

Work setting

The worker performed a variety of janitorial tasks in a school setting, including floor care and setting up rooms for school.

Obstacle

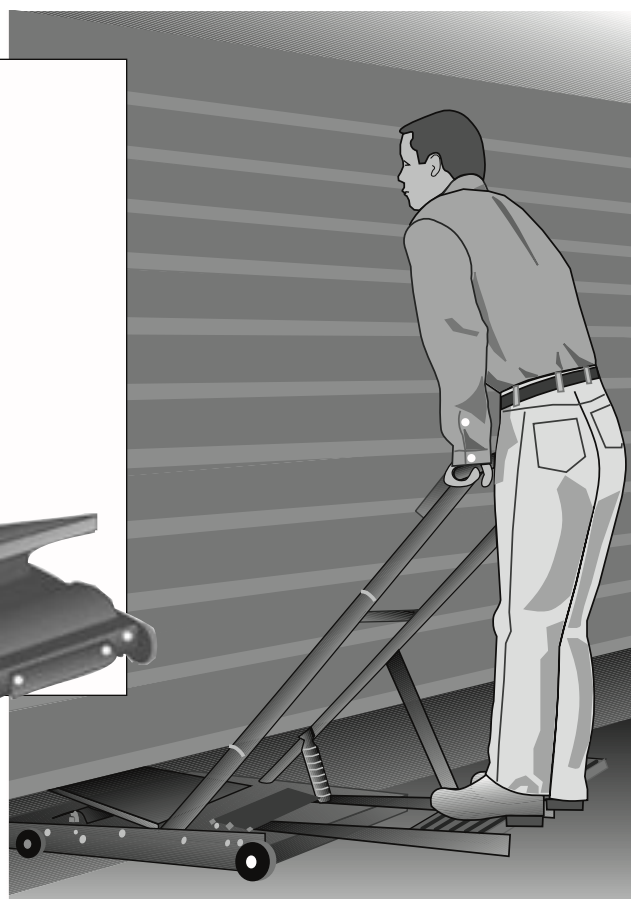
The worker, with the help of a coworker, was required to push the bleachers in the gym to a collapsed position for events that required more space or to do gym floor maintenance. He also had to pull them back into position for use.

Modification

A portable electric unit was provided to open and close the bleachers, with which the worker can single-handedly open and close the bleachers without straining his injured knee.

Cost of modification

The bleacher opener/closer costs about \$2,400.



Chain hoist — electric

Worker disability

A 40-year-old welder/fabricator injured his left knee and developed bilateral carpal tunnel syndrome. These injuries resulted in a 10-pound lifting and carrying limit.

Work setting

As a welder/fabricator, the worker cuts metal tubing. This requires lifting and carrying metal tubes up to 24 feet long, weighing 50-100 pounds.

Obstacle

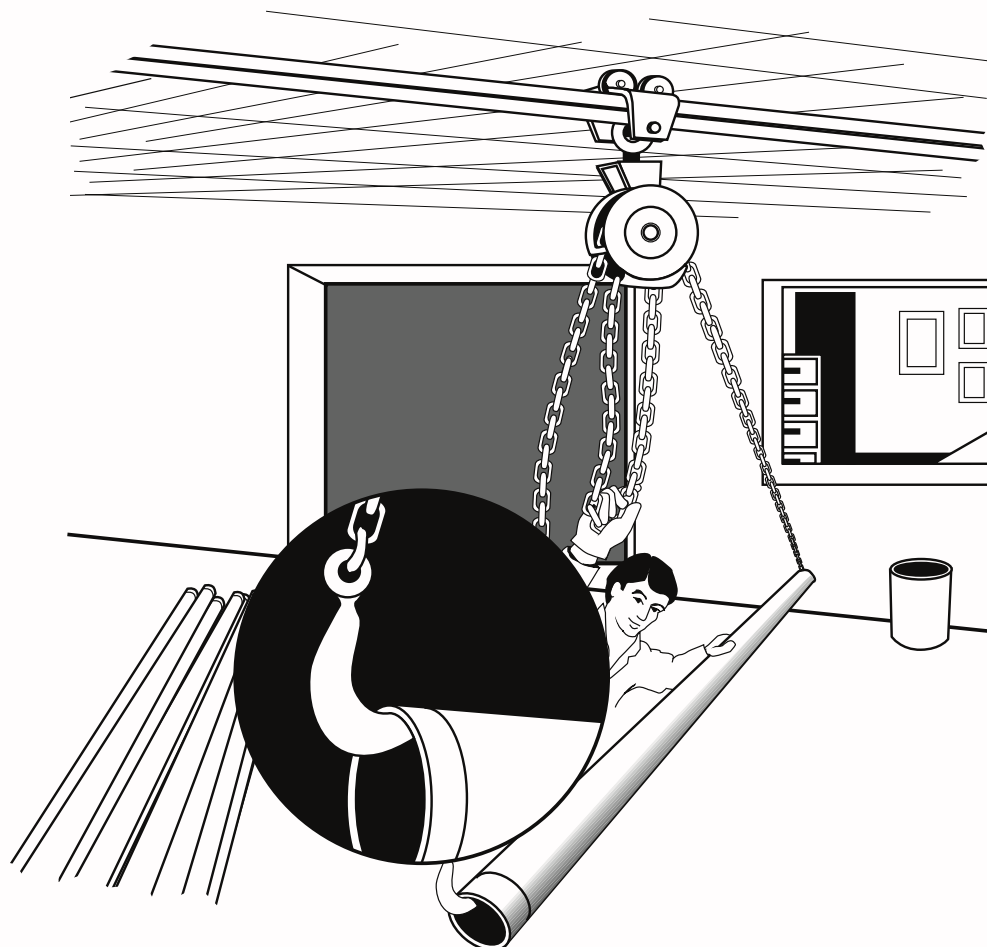
Lifting and carrying metal tubing weighing more than 50 pounds.

Modification

An overhead electric chain hoist attached to a trolley beam allows the worker to attach clamps to both ends of the tube and lift it to the saw tables and conveyor rolls. This allows the worker to avoid lifting more than 10 pounds.

Cost of modification

The electric chain hoist costs about \$2,000.



Grinder/polisher — counterbalanced swing-arm

Worker disability

A 46-year-old clutch-plate rebuilder strained his lower back.

Work setting

He returned to work as a machine operator with a new employer. Eighty percent of his job consists of polishing lightweight aluminum parts.

Obstacles

The pieces of aluminum, weighing from 1 to 10 pounds, are polished on

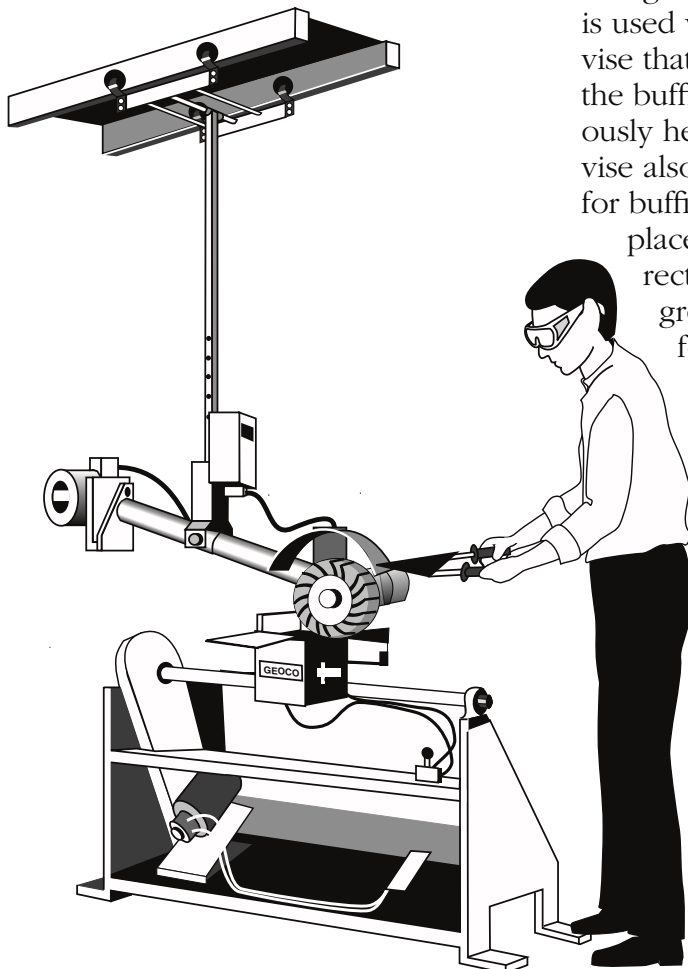
a standard fixed buffing wheel. The bending forward, pushing, and twisting to push pieces against the buffing wheel requires significant upper body strength, resulting in continued low-back problems.

Modifications

An overhead counterbalanced swing-arm grinder/polisher was installed. It is used with a pneumatic rotating air vise that holds the parts firmly against the buffing wheel. (Parts were previously held by the worker.) The air vise also rotates the parts in position for buffing. The swing-arm polisher places 10-18 pounds of weight directly onto the polishing head, greatly reducing the amount of force exerted by the worker to achieve the desired polishing effect. Bending forward while bearing down is no longer required.

Cost of modifications

The counterbalanced swing-arm grinder/polisher costs about \$8,000; swing-arm polisher/grinder, \$5,495; pneumatic rotating air vise, \$1,495; and custom-built fixtures to hold aluminum parts, \$900.



Paper roll — aluminum

Worker disability

A 31-year-old paper/overlay maker injured his back, which resulted in a 40-pound lifting and carrying limit.

Work setting

The job requires the worker to lift and carry steel rolls weighing 72 pounds 16 to 20 times a day, removing and inserting them into an arbor machine.

Obstacle

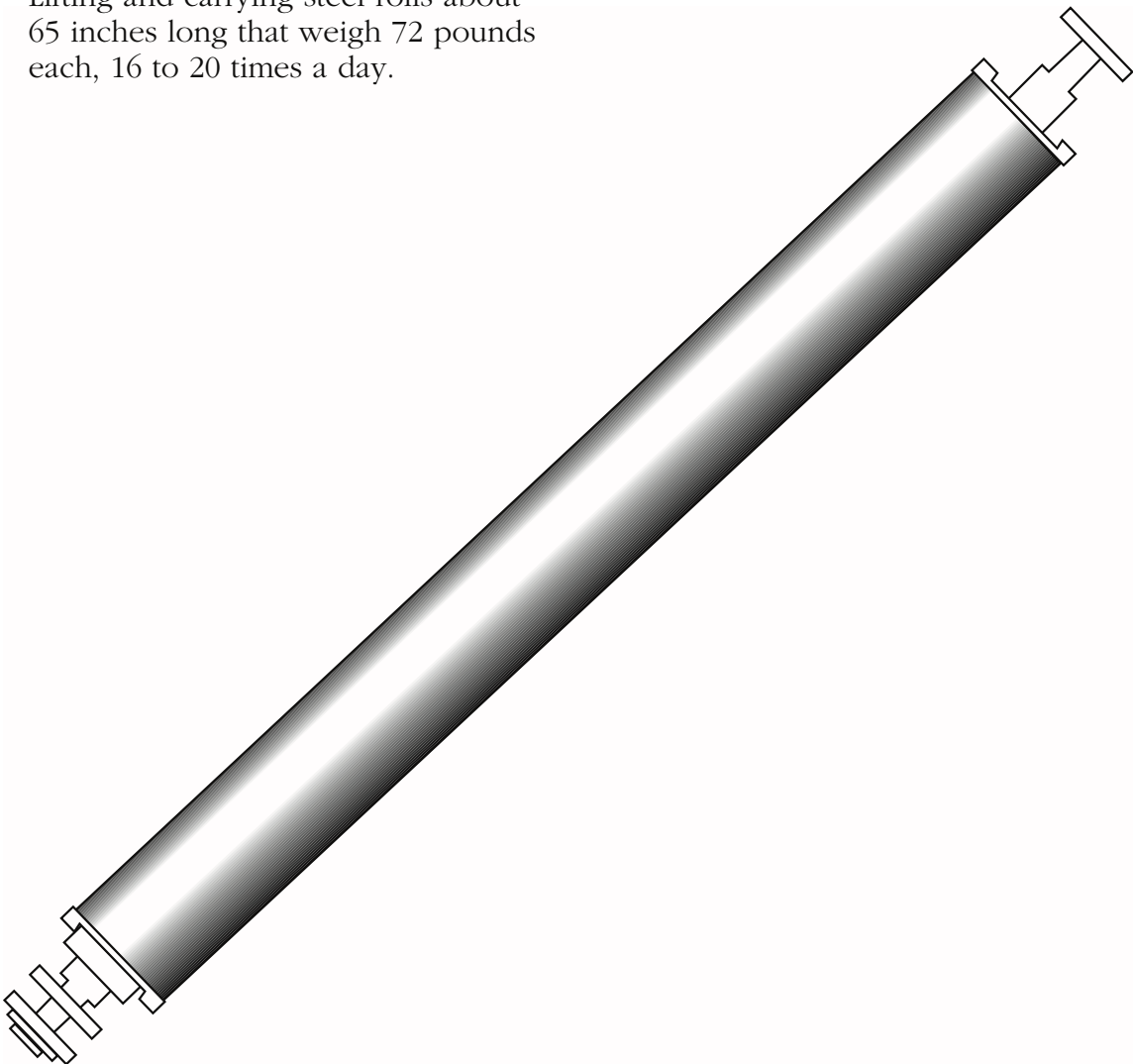
Lifting and carrying steel rolls about 65 inches long that weigh 72 pounds each, 16 to 20 times a day.

Modification

The fabrication of 30-pound aluminum rolls to replace the steel rolls.

Cost of modification

The aluminum paper roll costs about \$700.



High-lift order selector

Worker disability

A 43-year-old sheet-metal laborer slipped on an icy surface, twisting his lower back. He received 26 percent unscheduled permanent disability with restrictions on lifting, forward bending, and climbing.

Work setting

Unable to return to construction work, the worker found a new job as a printer and warehouseman with a custom screen-printing company on the Oregon coast. The employer prints custom designs on t-shirts and sweatshirts. The shop consists of an open, concrete-floored building with a large storage mezzanine covering approximately one-quarter of the main floor.

Obstacles

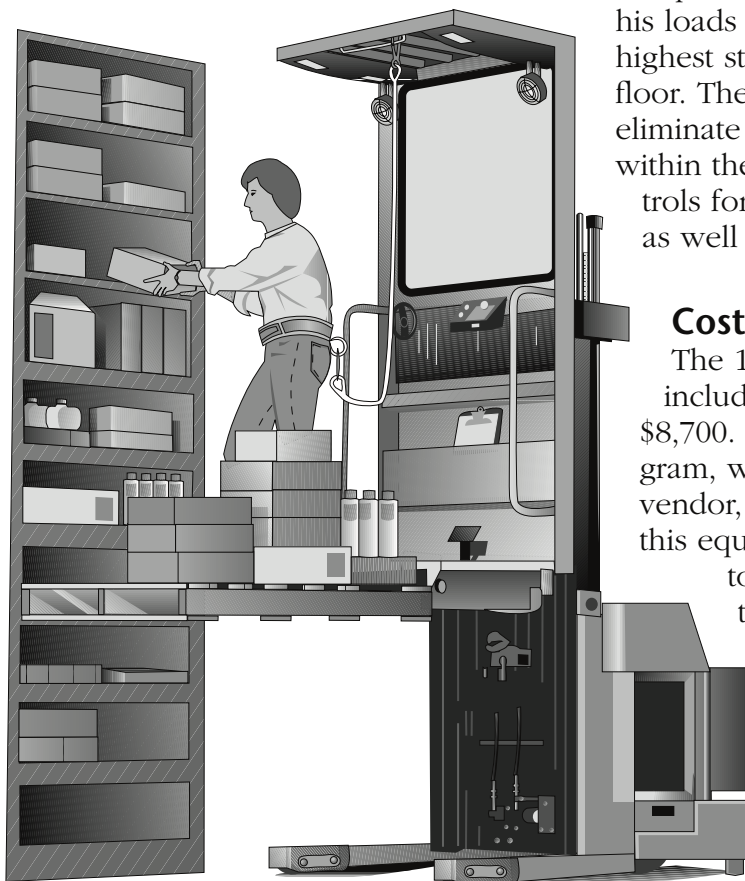
With a 40-pound lifting limit and restrictions on climbing and bending, the worker had difficulty carrying screens and boxes of shirts from the main floor to the mezzanine of the building. He could not use a ladder to reach the highest storage shelves on the main floor.

Modification

With the assistance of a materials-handling vendor, the Preferred Worker Program located a used battery-powered order picker that lifts the operator and his loads to the mezzanine and to the highest storage shelves on the main floor. The unit is mobile enough to eliminate almost all carrying of boxes within the facility. The operator controls forward and reverse movement, as well as up and down positioning.

Cost of modification

The 1993 used order picker, including delivery, costs about \$8,700. The Preferred Worker Program, with the cooperation of the vendor, permitted the parties to rent this equipment for a two-week trial to ensure that it would meet the employer's and worker's needs. Rental costs did not apply to the total cost of the modification.



Ladder — rolling stairs with platform

Worker disability

A 29-year-old recreational-vehicle technician injured his lower back, which resulted in limitations on bending, twisting, standing, and sitting.

Work setting

The worker does RV mechanical work, which includes crouching to work on brakes and working from ladders to service the air conditioners. As the service manager, he is also required to sit at a desk to do paperwork.

Obstacles

The worker was released for medium-duty work with limitations on crouching, bending, sitting, and standing.



Modifications

A rolling stair with a platform at the top was provided to eliminate twisting while working from a ladder. A sit/stand stool was placed at the workbench to allow the worker to take the weight off his legs while working at a standing height. An ergonomic chair was provided to increase the amount of time the worker could sit to do paperwork.

Cost of modifications

The rolling stair costs about \$515; sit/stand stool, \$301; and ergonomic chair, \$450.

Rolling stairs

See also "sit/stand stool" on Page 70

Ladder — three-step with safety bar

Worker disability

A 33-year-old nursing home laundry worker suffered a cervical strain that left him permanently restricted from working above shoulder level and from lifting/carrying more than 25 pounds.

Work setting

The worker's duties included washing and drying bed linens and towels, folding them, and storing them on shelves. Housekeeping staff retrieved the clean linens from the shelves and took them to residents' rooms.

Cost of modification

The three-step ladder with safety bar costs \$240.

Obstacle

The worker was required to place clean linens on storage shelves that were as high as 72 inches from the floor. In order to use the uppermost shelves, the worker had to lift and place the linens at a height above his shoulder level.

Modification

A three-step aluminum ladder was purchased for the worker. The ladder had wide steps for stability, a safety bar at the top, and a top-step height of 27 inches. It weighed only 20 pounds; the worker could move it easily within his restrictions. Using the ladder, he was able to place clean linens on the top storage shelves without difficulty.



Scaffolding and materials lift

Worker disability

A 57-year-old journeyman carpenter tore his rotator cuff and developed carpal tunnel syndrome.

Work setting

The employer installs folding room dividers in commercial buildings. This requires installing tracks on beams and ceilings of buildings. Normally, workers hold tracks against beams with their shoulders while standing on scaffolding.

Obstacles

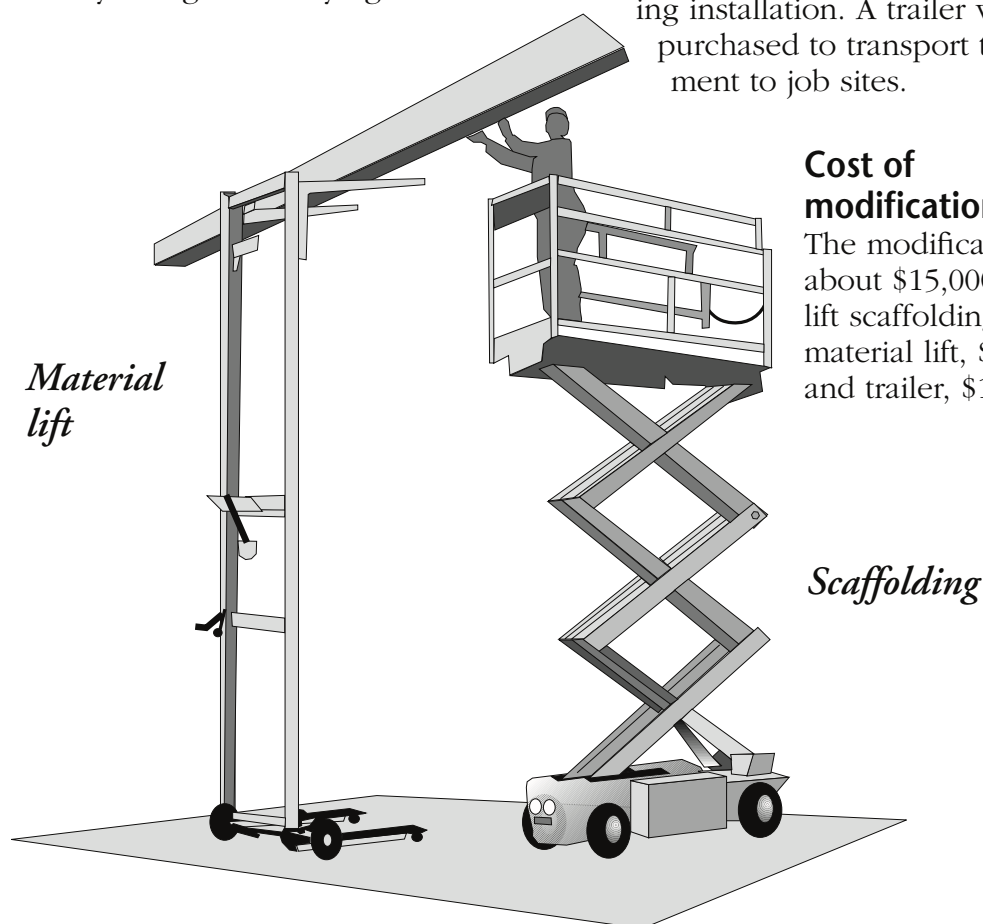
The worker was restricted from climbing and overhead work and heavy lifting and carrying.

Modifications

Scissors-lift scaffolding and a material lift were purchased to allow the worker to work at heights without having to climb ladders or carry materials. The track lies on top of the guardrails on the scissors-lift, which holds it securely against the beam. The worker has room on the platform of the scissors-lift to stand at one side of the beam while attaching the track to the beam. The material lift supports the other end of the track during installation. A trailer was also purchased to transport the equipment to job sites.

Cost of modifications

The modifications cost about \$15,000; scissors-lift scaffolding, \$12,491; material lift, \$1,129; and trailer, \$1,375.



Stock picker

Worker disability

A 35-year-old sales clerk sprained her left knee and was permanently restricted to standing/walking for a maximum of three hours a day and standing for no more than one hour at a time. She was restricted to intermittent climbing of stairs and lifting up to 24 pounds.

Work setting

The worker was offered a new job with her employer at injury as a stockroom supervisor. Her duties included maintaining store inventory and supervising stockroom staff.

Obstacles

Part of her duties included occasionally lifting and carrying boxes weighing more than 24 pounds and occasionally to frequently climbing a flight of stairs in the stockroom, sometimes while carrying boxes. Performing these tasks would exceed her permanent restrictions.

Modification

The Preferred Worker Program provided an electric telescopic stock picker that allows her access to the upper level of the stockroom without climbing stairs. A contractor made a custom gate and railing that allow the worker to enter the upper level directly from the stock picker. A custom step also allows the worker to use the stock picker from floor level. A load lifter allows the worker to lift and carry boxes and loads weighing more than 24 pounds.

Cost of modification

The cost of the electric stock picker, including shipping, was \$6,261. The load lifter, with shipping, cost \$685. Contractor charges were \$675. Total worksite modification cost was \$7,621.



Stock picker

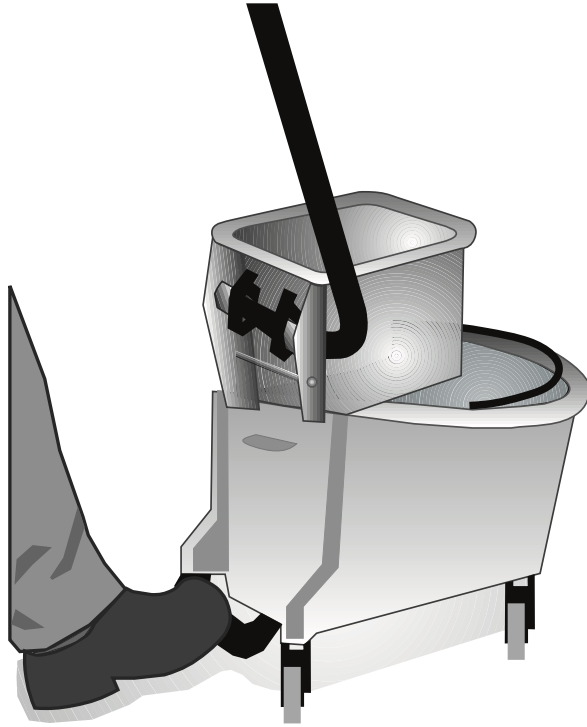
See also "load lifter" on Page 26

Process automation

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Process automation

Many jobs include manual tasks that could be automated to eliminate injury-causing trauma to the worker's body. Even when equipment is automated, especially if it is older, the automation may be designed to get the job done, but not to reduce or eliminate physical stress to the operator. The good news is that, as awareness of ergonomics increases, equipment designs more frequently address ergonomic issues. Therefore, you may find a solution to your workplace ergonomics challenge simply by researching updated equipment.



It may be less expensive to retrofit existing equipment with modifications that load, unload, cut, punch, press, manipulate, or perform some other part of the work process automatically. Ask the service department of the company that sold the equipment or ask other industrial suppliers about automating troublesome tasks.

The following pages contain a few examples of modifications that have automated processes to reduce or eliminate lifting, bending, squatting, kneeling, twisting, pushing, gripping, and repetitive hand use. One modification was designed to compensate for loss of strength and another to address cognitive deficits. The possibilities are endless!

Barrel dumper

Worker disability

A 43-year-old elementary-school custodian ruptured a disc in his back while emptying bags of trash into a garbage bin.

Work setting

The worker shares janitorial duties with another custodian in a large public school.

Obstacles

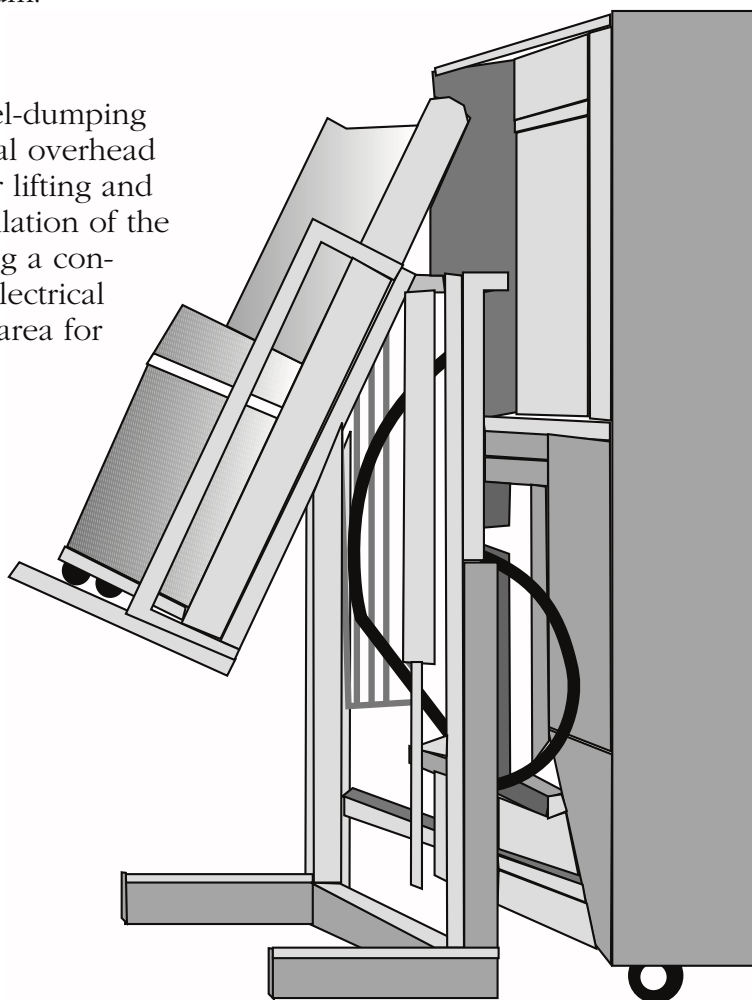
Following back surgery, the worker was permanently restricted from overhead lifting of more than 45 pounds, and he was instructed to keep lifting and carrying to a minimum.

Modifications

An automated trash-barrel-dumping system eliminates manual overhead lifting and reduces other lifting and carrying demands. Installation of the dumper required pouring a concrete pad, hooking up electrical power, and fencing the area for security.

Cost of modifications

Total cost for modifications was about \$8,234; trash barrel lifter/dumper, \$5,965; 100-gallon trash container, \$290; electrical hookup, \$999; concrete pad, \$300; and fencing, \$680.



Capping-machine tracking system

Worker disability

A 42-year-old capping machine operator in a manufacturing company that fabricates industrial food warmers injured her right shoulder. The injury resulted in her inability to push, pull, and twist.

Work setting

The worker slides aluminum strips from right to left while facing the tracking system so that the ends can be cut to specific angles. This requires pushing and twisting into the die for cutting.

Modification

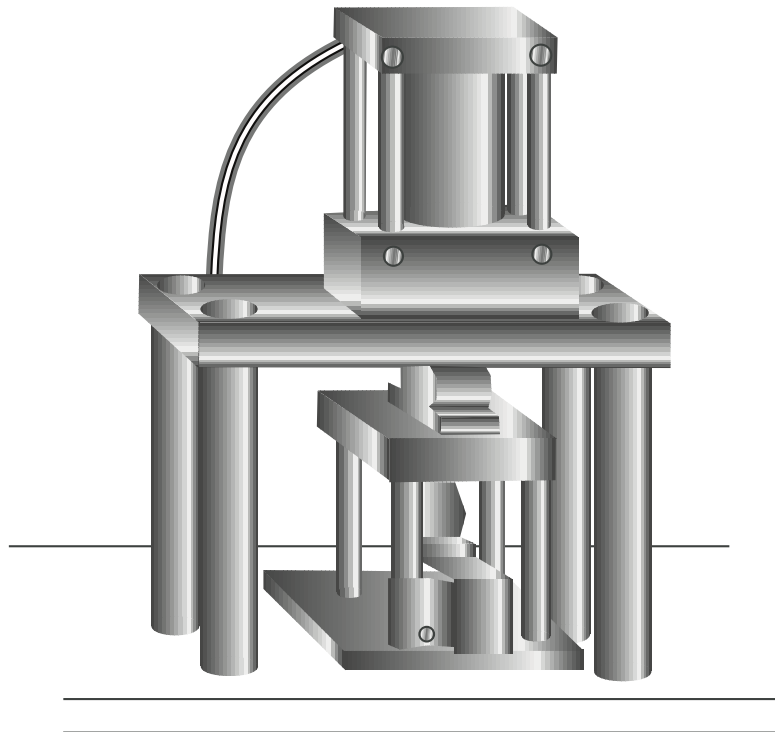
The program purchased a new tracking system to eliminate side movement. The worker now faces the capping machine and loads aluminum strips with a forward-pushing motion rather than a side-to-side twisting-and-sliding movement.

Obstacles

Lack of strength of the right shoulder to push, pull, and twist.

Cost of modification

The capping machine tracking system costs about \$11,000.



Computer hardware/software — custom

Worker disability

A 38-year-old engineering technician, primarily involved in surveying for map making, sustained a brain injury when struck by an automobile.

Work setting

The job at injury requires surveying and producing computer-generated reports using a mainframe computer.

Obstacles

The worker has documented losses in short-term memory, abstract problem solving, judgment, and ability to analyze. As a result, the worker is unable to properly encode legal survey documents into the computer, remember the sequence of computer cues without frequent prompting, and file correctly, making the files unretrievable.

Modifications

The worker retains his long-term memory of various facets of surveying. He shows success when information is presented to him visually, choices are limited, and the tasks are

sequential and/or concrete. The worker is re-employed with the employer at injury in a modified position as a survey technician – a position requiring less problem-solving and verbal interaction.

For the worker to be fully productive, a special software program was designed that uses visual cues, frequent prompting to remind the user what he is doing, and built-in corrective features to prevent the worker from losing data in the system. A personal computer and printer were also provided to avoid interfacing this worker's computer with the mainframe.

Cost of modifications

The custom computer hardware/software costs about \$15,347; consultative services contract, \$1,100; computer hardware, \$4,068; and custom software, \$10,179.



Maintenance deck — designed with custom wheels

Worker disability

A 52-year-old man injured his lower back, resulting in permanent work restrictions precluding lifting or carrying more than 50 pounds and repetitive bending and twisting.

Work setting

The worker's job at injury was maintenance supervisor. He was responsible for maintaining and servicing machinery and equipment in a potato/onion packing plant. His employer-at-injury was willing to keep him on in that capacity, but the worker needed assistance.

Obstacles

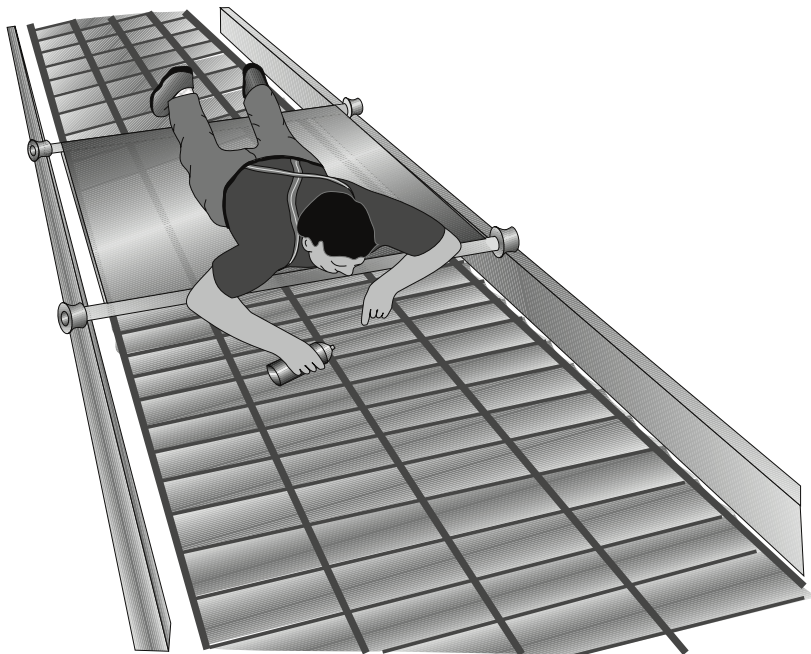
Frequent bending and twisting postures were required for maintenance of the computerized weight-sensor lines. He was no longer able to squat and kneel or severely bend his torso to do this frequent task.

Modification

The Preferred Worker Program assisted in the purchase of a custom-fabricated wheeled deck that rolled along the steel frame of the sensor line. The worker lies prone on the deck to do required maintenance. He pulls himself to the next area requiring attention. This eliminates frequent bending and twisting and lifting and moving a heavy wooden plank that the worker had used before his injury.

Cost of modification

The custom-fabricated mobile deck costs about \$600.



Mixing bowl lift — hydraulic tilting

Worker disability

A 54-year-old food-service worker sustained bilateral upper extremity injuries. She had permanent limitations in repetitive use of her hands as well as a 15-pound lifting restriction for lifts above the waist.

Work setting

The worker is a baker who makes rolls, muffins, cookies, etc. She required a number of modifications to return to her job.

Obstacle

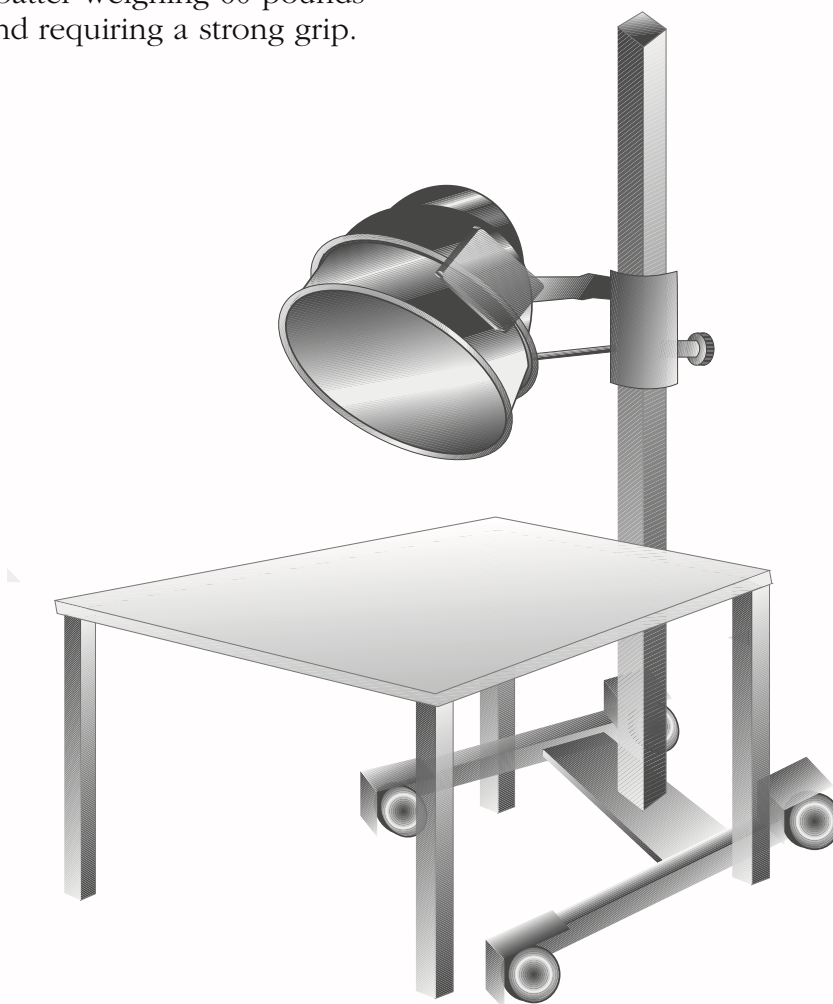
One substantial obstacle was lifting and emptying large mixing bowls of dough or batter weighing 60 pounds or more and requiring a strong grip.

Modification

A hydraulic container-handling device was purchased to lift the mixing bowls.

Cost of modification

The hydraulic bowl lift costs about \$6,000, depending on size.



Mixing/portioning system — large batch

Worker disability

A 33-year-old food batcher suffered a severe crush injury of her right hand, nearly amputating her right third and fourth fingers. This caused permanent decreased grip strength and loss of movement of all fingers. She can use only her thumb and index finger to pinch-grip. Therefore, she is only able to use her right hand as an assist to her left hand.

Work setting

The employer at injury is a company that makes pasta and pasta sauce. Some of the worker's duties involved heavy lifting of bulk ingredients. She was responsible for mixing ingredients for large batches of sauce, then measuring and packaging the product.

Obstacle

The worker could no longer do tasks involving heavy lifting of bulk ingredients. She could no longer mix sauce ingredients by hand in five-gallon containers or hand-fill several

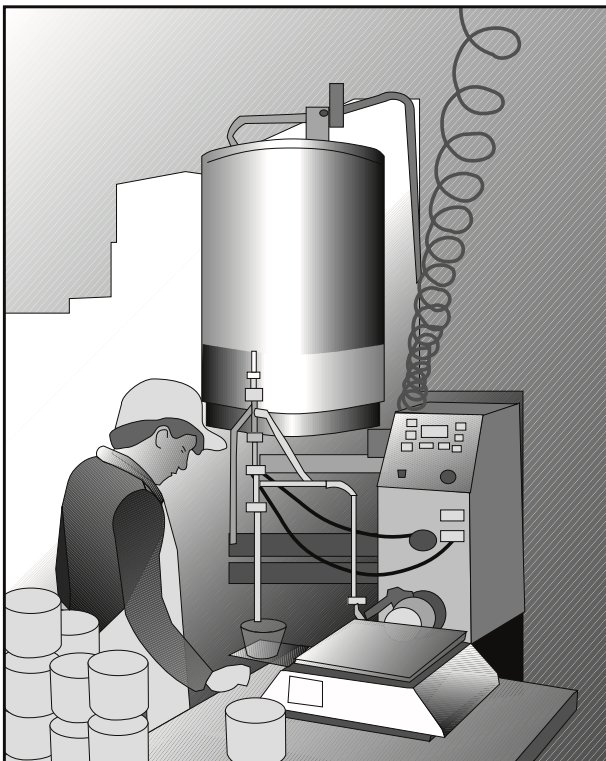
hundred plastic containers during each production cycle using a small measuring cup.

Modification

Upon her return to work, the employer reassigned the heavy lifting tasks to other workers. The Preferred Worker Program purchased computerized portioning equipment to automatically place sauce in four- and eight-ounce containers, which eliminated the repetitive use of the measuring cup. The employer designed a mixing procedure using a large drum and powered mixer to eliminate the hand mixing. The Preferred Worker Program provided a mix tank with stand, feed tank with stand, stacker, and other equipment to support the employer's design.

Cost of modification

The automated large-batch mixing system costs about \$9,200.



Mop bucket with drain valve

Worker disability

A 31-year-old aide in a residential care home injured her neck and right shoulder lifting a patient and had permanent limitations including reduced right shoulder range of motion, inability to repetitively use her right arm, inability to lift more than 10 pounds, limited side reaching, and no overhead reaching with her right arm.

Work setting

The worker got a new job as a group-home administrator, with more scheduling, supervising, and other administrative tasks than her previous job. However, she occasionally had to mop floors, which involved lifting a mop bucket from sink to floor.

Obstacle

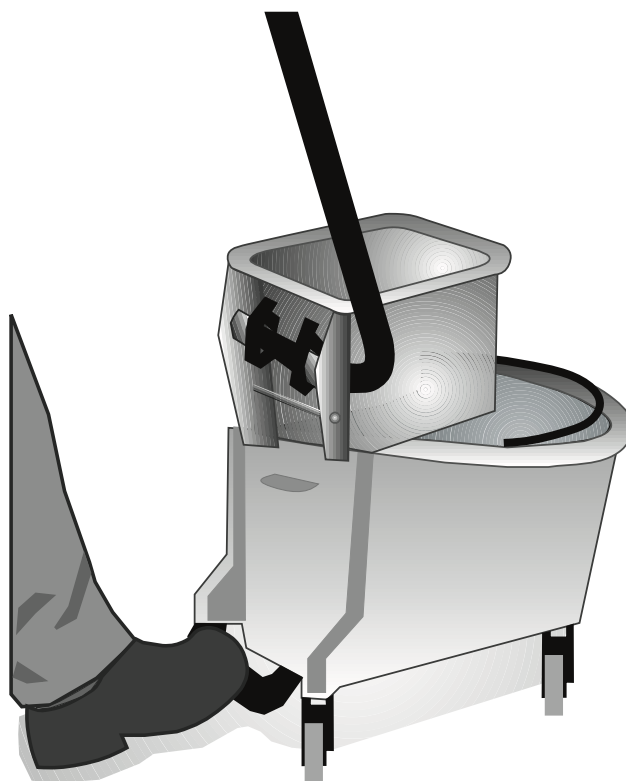
While the worker could lift the empty mop bucket to the utility sink to fill it, she could not lift it to the floor when filled or lift the bucket to the sink to empty it.

Modification

A hose was attached to the utility sink faucet for filling the mop bucket at floor level. A mop bucket with a foot-activated drain valve was purchased to enable the worker to empty the bucket at the floor drain.

Cost of modification

The bucket with foot-activated drain valve costs about \$115.



Sewing machine — long-arm

Worker disability

A 24-year-old sewing machine operator injured her right wrist, then underwent surgery for carpal tunnel release. The injury resulted in limited use of her right hand.

Work setting

Sewing machine operators use their right hands to lift and hold up reverse levers about 1,200 times a day and to do many other sewing tasks.

Obstacles

The job requires the worker to use her right hand to repetitively hold up the reverse lever (7-8 pounds), turn the flywheel, fold and hold down material while feeding it into the needle, and cut thread with scissors.

Modification

The purchase of an long-arm sewing machine, which accomplishes these tasks with foot pedals.

Cost of modification

The long-arm sewing machine costs about \$4,000.

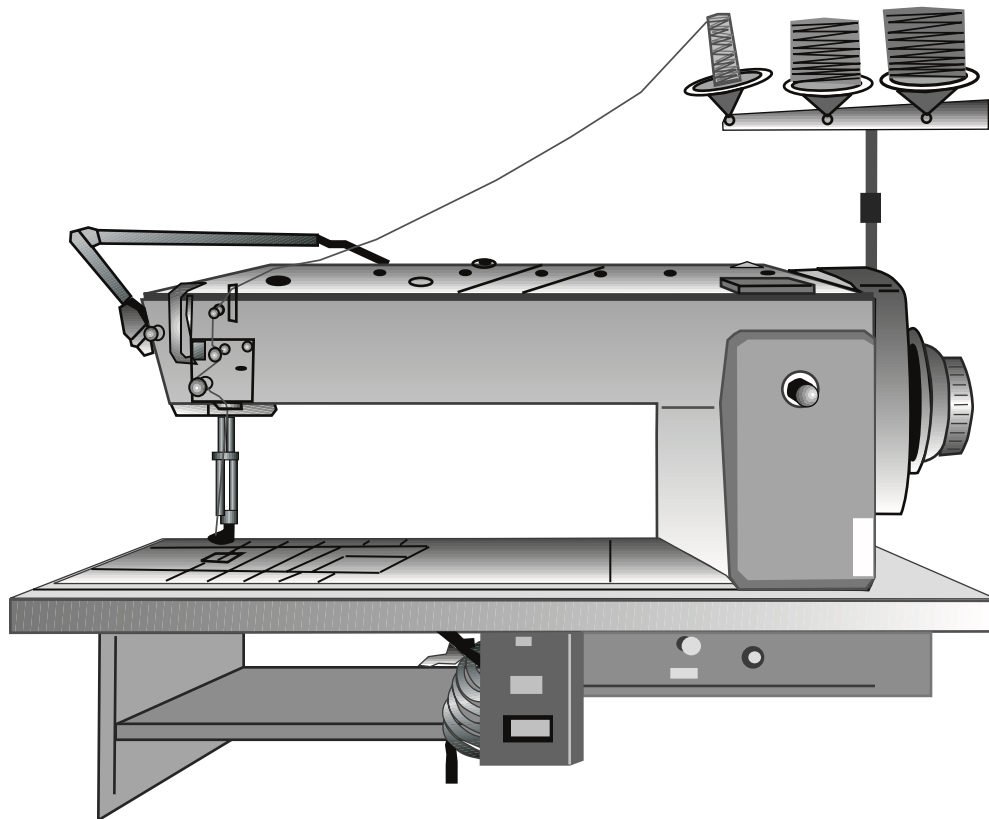


Table saw — power feeder

Worker disability

A 25-year-old specialty carpenter lost his thumb while operating a table saw. This resulted in a strength loss that precluded holding material down while pushing it through the saw and guiding wood to keep it close to the fence.

Work setting

The worker operates the table saw to make specialty cuts for doors and window frames.

Obstacle

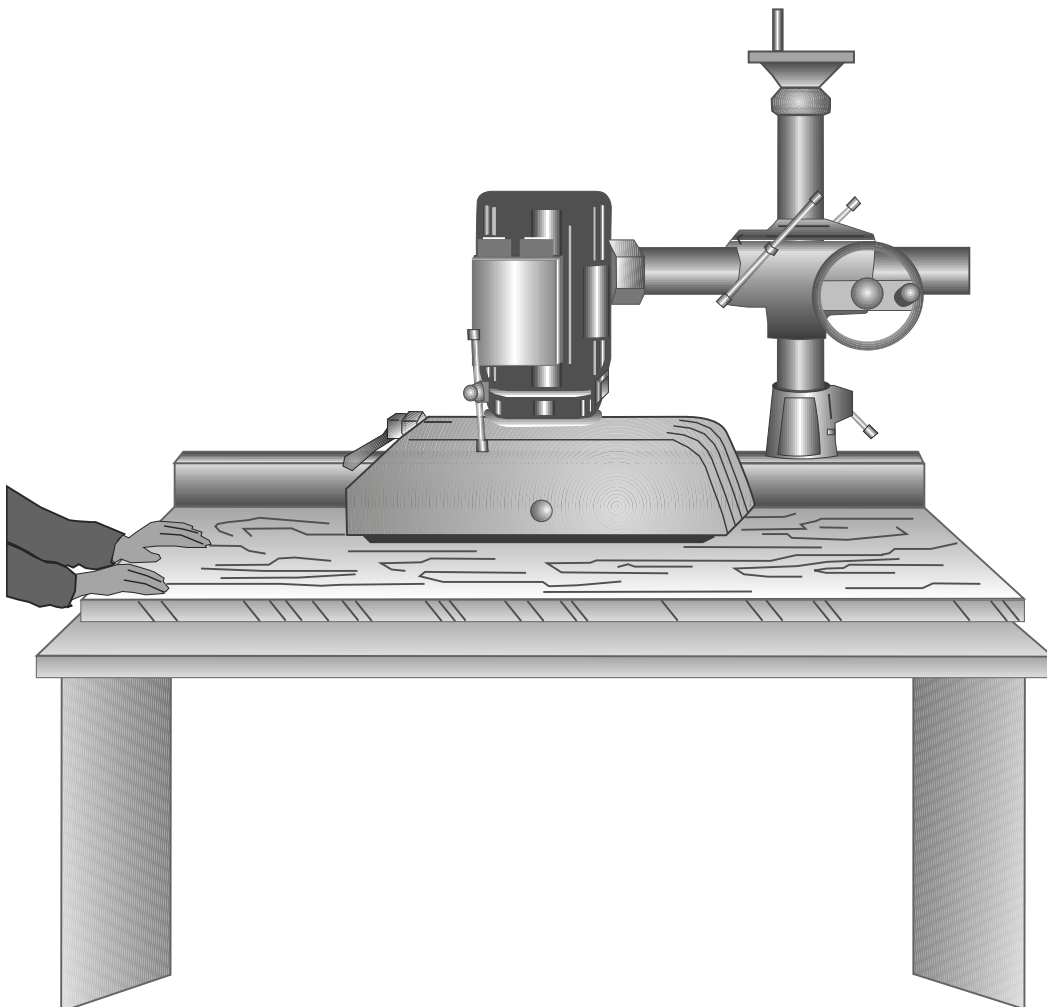
The inability to hold and push material through the table saw.

Modifications

The purchase of a power feeder that attaches to the table saw and automatically powers the material through and holds it against the fence.

Cost of modification

The power feeder/table saw costs about \$750.



Seating

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Seating

Chairs

A chair must fit the person using it, the task for which it is intended, and its environment. When environmental factors, task requirements, and individual preferences have been determined, consider individual dimensions before selecting a chair. Here are the key factors in selecting a chair:

- **Stability** — Choose a chair that has good stability (five-point base).
- **Seat** — An ideal seat-pan length allows two to three fingers' width (about $3\text{--}3\frac{1}{2}$ inches) from the front edge of the seat to the back of the lower leg at the knee when the worker's back contacts the backrest.
- **Seat-pan angle** — The seat pan should adjust to positive, flat, or negative angles. The worker must be trained in the benefits of each angle adjustment.
- **Chair-height adjustment** — The height of the seat pan must be pneumatically adjustable by the operator when seated.



Ideally, the chair height should be adjusted first and then the workstation adjusted. In the event that the work surface is too high, the chair height needs to be adjusted upward until the hand, wrist, and forearm are parallel to the keyboard and slightly above the keys.

A footrest can then be added as needed to compensate for the increased chair seat height.

Seat-pan padding

Hard, unpadded seat pans are uncomfortable to sit on for more than an hour. Soft, deeply padded seat pans cause a person to sink too far, transferring the weight load from the buttocks to the surrounding tissues. This causes tension in the hip muscles and becomes uncomfortable. The seat pan design should promote lower back contact with the backrest.

The front edge of the seat pan should have a softly padded, rounded front edge (waterfall edge). Straight, unpadded seat pan front edges compress thigh tissues, restricting blood circulation. This causes pain and leg numbness. Seat-covering material should be porous and breathable. Slippery seat pans may cause the operator to slide away from the backrest, thus providing little back support.

Backrests

Backrests should have a 15- to 20-inch-high support surface and about a 13-inch width, they should be vertically adjustable above the seat pan, horizontally adjustable over the seat pan, and should contour to the curve of the lower back. The backrest should be large enough to support the entire back, including the lumbar (lower back) region, but not so large that it

interferes with the use of the arms during the performance of tasks. Chairs are available with sliding seat-pan adjustments for better back support.

Armrests

If chairs have armrests, the armrests should be adjustable to the user's width and height. Armrests should allow the chair to fit under the work surface so that the user can get close enough to his or her work while continuing to use the chair's backrest. Armrests that are too high elevate the shoulders, causing stiffness or pain in the shoulder or neck muscles. Armrests that are too low promote slumping and leaning to one side.

Back problems

Back pain is a common complaint. The back is a very complex structure; back problems can result from several causes.

Problem: A chair that fails to support the lumbar (lower) region of the spine is a common cause of back discomfort, because up to 35 percent more pressure can be placed on the lower back when sitting. The normal alignment of the spine, if viewed from the side, is an S-shaped curve with an inward curve at the neck, an outward curve in the middle of the back, and an inward curve at the lower back, the lumbar region. When a chair does not provide adequate lumbar support, the lower curve of the back flattens. When a person is seating himself, the bottom of the hipbone contacts the chair first. As the sitting process is completed, the hip actually rotates backward, flattening the curve in the lower part of the back. This causes the spinal discs to stretch from the vertebrae, causing back discomfort.

Solution: A chair that provides good low-back support and has the back-rest set at the proper height can maintain the normal alignment of the lower spine, relieving fatigue and discomfort. Adjustment of the seat tilt can also maintain a comfortable alignment of the lumbar spine.

Problem: A straight-back chair provides little or no support to the lower and upper back. Sitting in such a chair causes back fatigue from muscular efforts to maintain back posture.

Solution: A tiltable backrest allows the user to change positions, reducing muscular effort and fatigue from sitting. A slight backward recline also helps to reduce the flattening of the lower spine when sitting.

Problem: When a chair is too soft, the user sinks into the seat pan. This restricts movement and causes thigh, buttock, and lower back fatigue. Conversely, when a chair is too hard, a user may need to change postures frequently to relieve thigh and buttock discomfort.

Solution: People spend much of their time at work sitting. This is especially true of video display terminals (VDT) operators. A VDT user's chair should be designed to allow free movement while sitting. The chair must be properly designed for comfort, efficiency, and the task. Because VDT users' chairs are very personal items, users must be involved in the selection and purchase of chairs. This will ensure that users are satisfied with their chairs and that the best chair has been selected for each user.

How to select seating equipment was excerpted from Oregon OSHA's *Health and Safety Guidelines for Video Display Terminals in the Workplace*.

Air-ride seat

Worker disability

A 32-year-old log-truck driver was involved in a car accident that resulted in a disabling back injury. The worker had limited tolerance for sitting, particularly when bouncing and jarring.

Work setting

Truck driving required sitting for up to two hours at a time and driving over rough terrain with continuous bouncing and jarring.

Obstacle

Worker cannot sit for more than 30 minutes with continuous bouncing and jarring.

Modification

An air-ride seat minimized jarring through special construction, including an adjustable lumbar support, air shock, and scissors suspension. As a result of the modification, 75 percent of the bouncing was absorbed.

Cost of modification

The air-ride seat cost about \$900 (installed).



Custom saddle

Worker disability

A 30-year-old ranch hand dislocated his hip when his horse stepped into a hole and rolled over him.

Work setting

The worker tends cattle on a large ranch and spends much of his time on horseback.

Obstacles

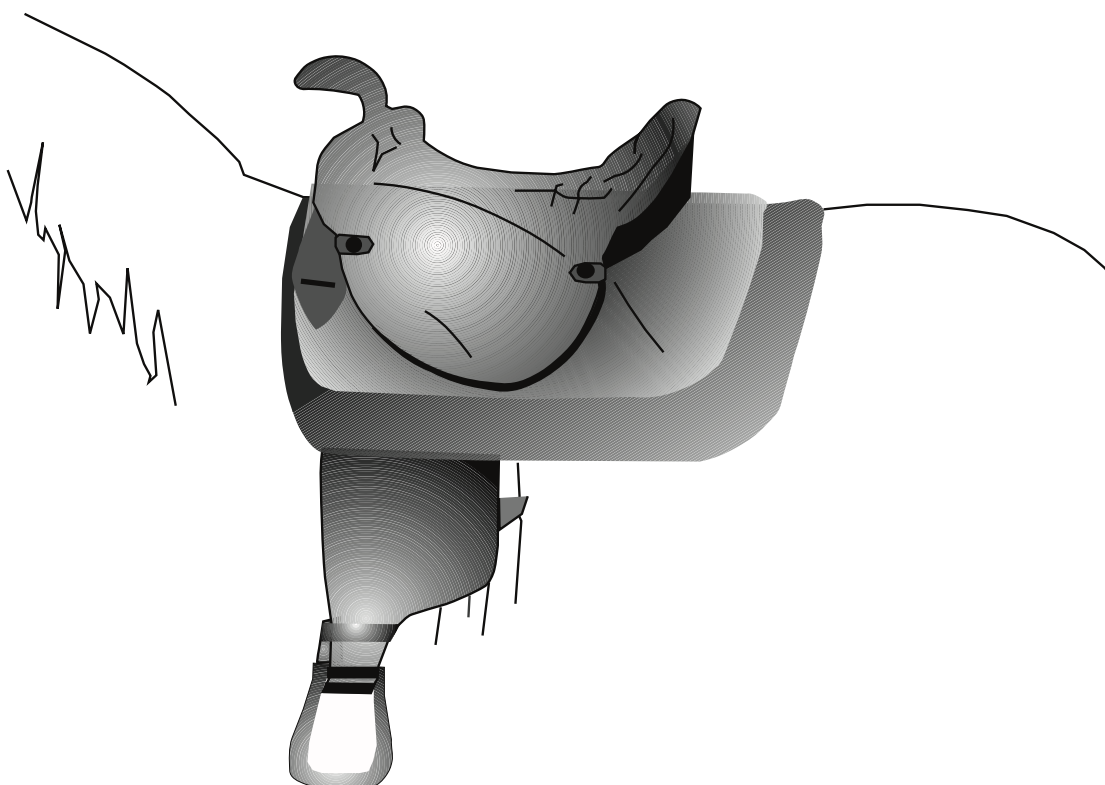
The hip required surgery. Following surgery, the worker could feel a mass in the posterior of his hip while seated. He could no longer ride a horse long enough to perform all his job duties.

Modification

A custom-made saddle with additional padding fitted to the worker's anatomy was provided. This allowed the worker to spend enough time in the saddle to perform his regular work.

Cost of modification

The custom-made saddle cost about \$1,650.



Sit/stand stool

Worker disability

A 29-year-old recreational-vehicle technician injured his lower back, which resulted in limitations on bending, twisting, standing, and sitting.

Work setting

The worker does RV mechanical work, which includes crouching to work on brakes and working from ladders to service the air conditioners. As the service manager, he is also required to sit at a desk to do paperwork.

Obstacles

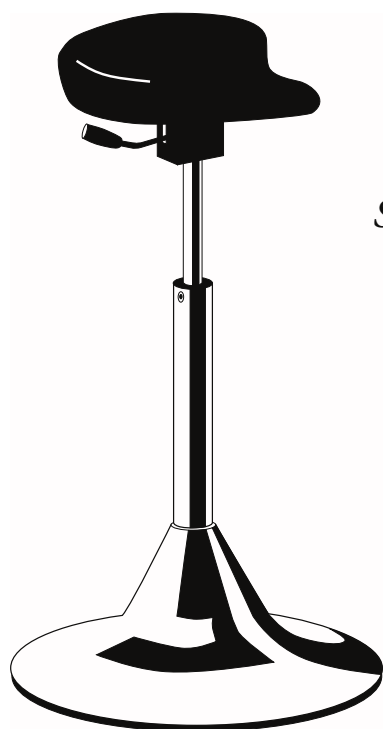
The worker was released for medium-duty work with limitations on crouching, bending, sitting, and standing.

Modifications

A rolling stair with a platform at the top was provided to eliminate twisting while working from a ladder. A sit/stand stool was placed at the workbench to allow the worker to take the weight off his legs while working at a standing height. An ergonomic chair was provided to increase the amount of time the worker could sit to do paperwork.

Cost of modifications

The sit/stand stool cost about \$300; rolling stair, \$515; and ergonomic chair, \$450.



Sit/stand stool

See also “rolling stairs” on Page 49

Suspension seat

Worker disability

A 26-year-old ranch hand/assistant manager was bucked off his horse, which resulted in a lumbar spinal trauma. Thereafter, he had limitations on repetitive lifting and bending along with a decreased tolerance for sitting.

Work setting

As a ranch hand/assistant manager, the worker had to load and unload 80- to 120-pound hay bales from a flatbed truck daily. He also operated a tractor to cultivate a 200-acre field of alfalfa.

Obstacles

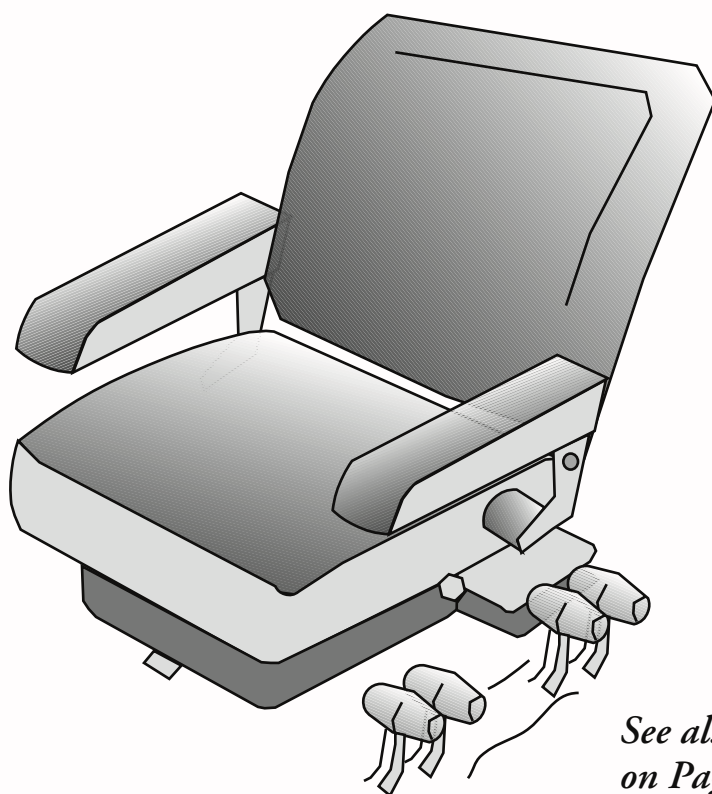
The worker had difficulty with repetitive lifting of hay bales and with jarring and bouncing on the tractor.

Modifications

The program purchased a power crane, power winch, trailer hitch, and step/bumper combination for a truck to allow the worker to perform the loading/unloading of hay bales. A rubber torsion support suspension seat with low back and arm support was attached to the tractor to allow the worker to sit for field-cultivation duties.

Cost of modifications

The truck accessories and the tractor suspension seat cost about \$2,100.



*See also “crane-bumper”
on Page 76*

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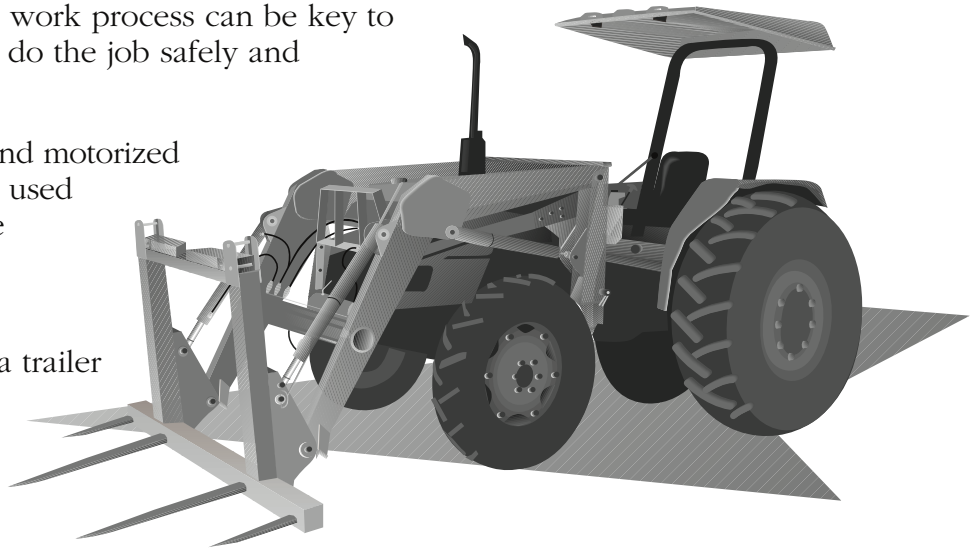
Utility tractor — compact 103

Vehicle modification

Vehicles used in the work process can be key to a worker's ability to do the job safely and successfully.

All-terrain vehicles and motorized utility carts are often used by people who have walking, lifting, and carrying restrictions.

The right choice of a trailer or attachment can save a trucker from climbing on loads and throwing tarps.



Various cranes and other positioners can be used to load and unload delivery trucks with little physical effort.

Attachments to small tractors and other machines can accomplish the digging, trenching, leveling, and hauling that landscapers and construction workers may otherwise have to do manually.

A variety of lifts and dollies help save the backs of the mechanics who handle parts while maintaining and repairing vehicles large and small.

This section contains a sampling of the many types of vehicles and vehicle attachments that can be used for worksite modification.

Cargo drawers

Worker disability

A 32-year-old traffic-signal technician suffered an over-use injury to her right arm and elbow. It required surgery. Upon recovery, she was released to sedentary/light work with no sustained overhead or shoulder-level work.

Work setting

Although the worker could not return to her job at injury, her employer offered her a new job as a locator/traffic-signal technician. Her job duties require her to travel to dozens of intersections throughout the city, stopping at 20-40 locations in a day. She finds and marks all storm lines, sanitary sewer lines, water lines, traffic signal loops, and power lines. She drives a standard-size pickup and must retrieve and replace her tools and equipment over the side of the truck into the bed area.

Obstacle

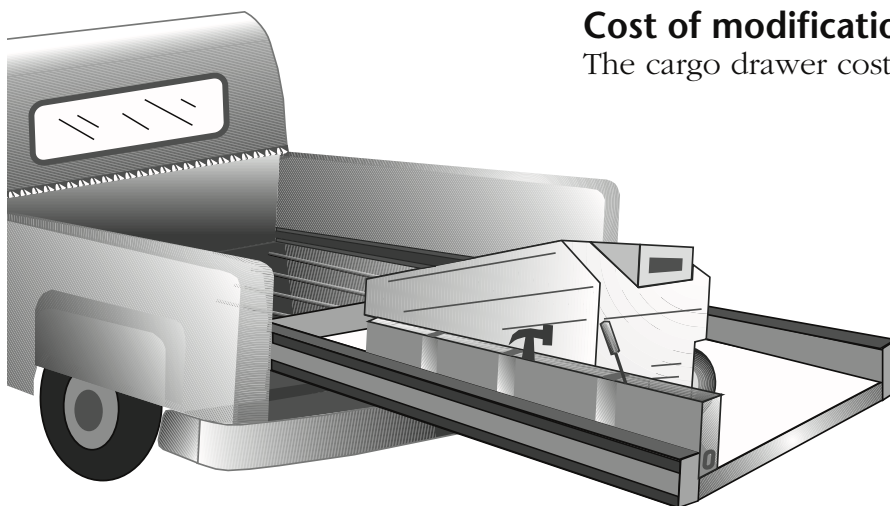
Worker exceeded her reaching limitations as she loaded and unloaded tools and equipment.

Modification

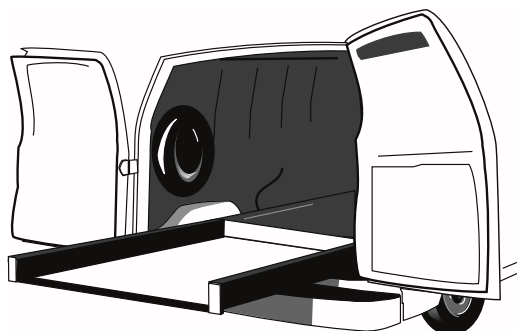
The program provided a cargo drawer mounted on the truck bed. It has built-in tool boxes on each side and a large compartment in the middle for larger equipment. This equipment allows the worker to handle her tools and equipment without exceeding her limitations.

Cost of modification

The cargo drawer costs about \$1,900.



*Also available
for vans*



Crane — bumper

Worker disability

A 26-year-old ranch hand/assistant manager was bucked off his horse, which resulted in a lumbar spinal trauma. Thereafter, he had limitations on repetitive lifting and bending along with a decreased tolerance for sitting.

Work setting

As a ranch hand/assistant manager, the worker had to load and unload 80- to 120-pound hay bales from a flatbed truck daily. He also operated a tractor to cultivate a 200-acre field of alfalfa.

Obstacles

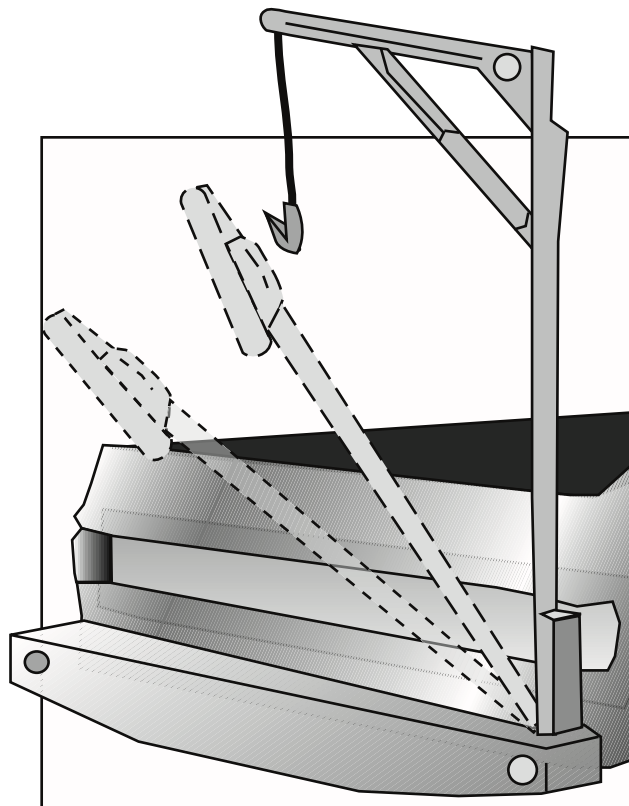
The worker had difficulty repetitively lifting hay bales and with jarring and bouncing on the tractor.

Modifications

The program purchased a power crane, power winch, trailer hitch, and step/bumper combination for a truck to allow the worker to perform the loading/unloading of hay bales. A rubber torsion support suspension seat with low-back and arm support was attached to the tractor to allow the worker to sit for field-cultivation duties.

Cost of modifications

The truck accessories and tractor suspension seat cost about \$2,100.



*See also
"suspension seat"
on Page 71*

Crane — truck-bed

Worker disability

A 31-year-old construction worker sustained a knee injury that left him with restrictions to lift and carry no more than 50 pounds. He was unable to return to his regular work, which required frequent lift/carry of materials weighing 100 pounds and more.

Work setting

The worker's employer-at-injury created a new job for the worker with project coordination responsibilities. He was sometimes required to transport miscellaneous supplies from supply outlets to construction sites. A company truck was assigned to the worker.

Obstacle

Loading and unloading some of the supplies, especially lumber products, was outside of the worker's restrictions. After a short time on the job, he found that assistance for material

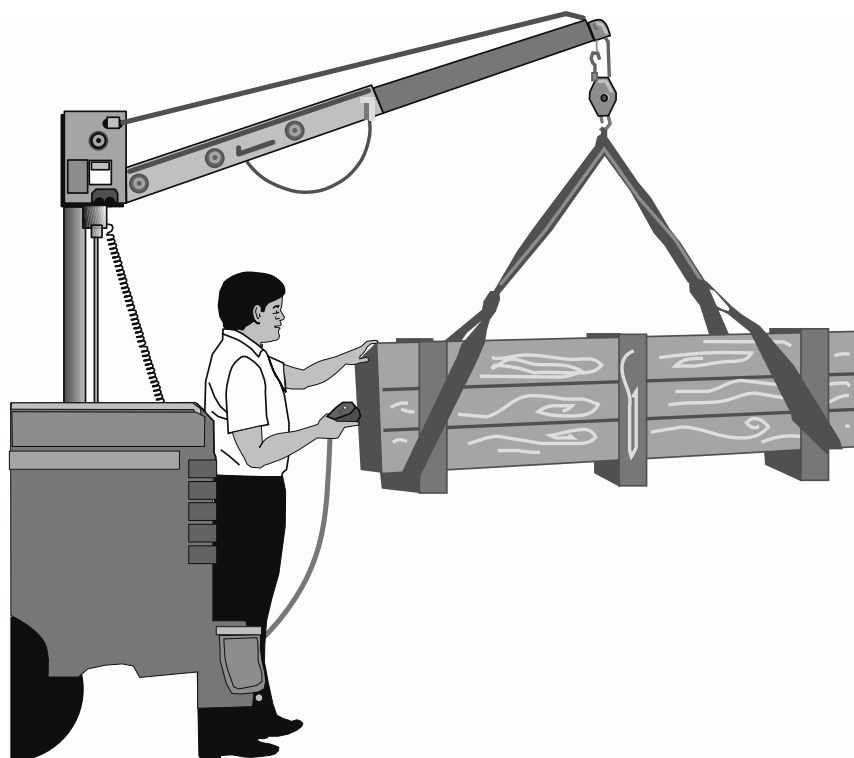
loading and unloading was frequently not readily available. The employer's schedule allowed little delay in loading and unloading materials.

Modification

An electric crane was mounted on the pickup. The crane has push-button controls and eliminates the need to manually lift loads in and out of the truck bed. The worker no longer needs assistance to do his job.

Cost of modification

The truck-mounted crane costs \$2,500.



Hand-control driving aids for the disabled

Worker disability

A 21-year-old heavy-equipment operator was making a mechanical adjustment on his machine when his winch broke and he fell back hard to a sitting position. The fall resulted in a spinal-cord injury that caused reduced range of motion and reduced strength in his hands and arms.

Work setting

The worker returned to work at the construction company, where he became a cost estimator/project manager. Although many of the duties are performed in a mobile office, it is necessary for him to use both his truck and an all-terrain vehicle (at construction sites) to accomplish some of his duties.

Obstacle

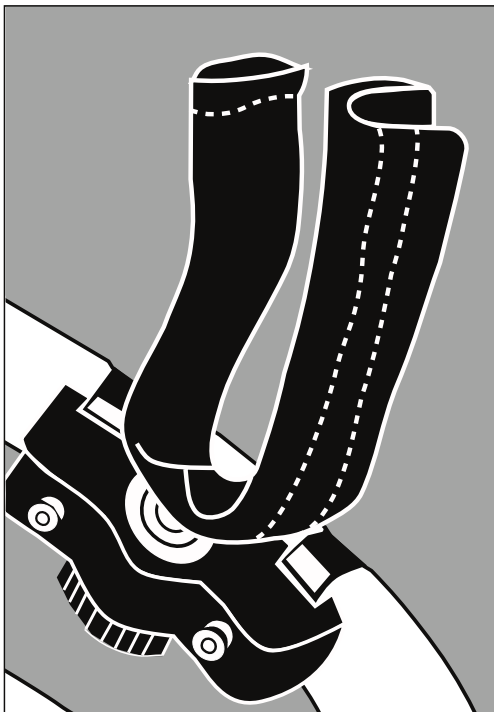
The worker is not able to position his hand properly on a vehicle steering wheel or to apply sufficient grip strength to the wheel.

Modification

Swiveling U-shaped cuffs were attached to the steering wheels of the worker's personal truck and ATV. His hand fits snugly into the device, which allows him to control the steering wheel without changing hand positions or gripping the wheel as is normally required.

Cost of modification

Cost of each "U-cuff" was \$79 plus shipping.



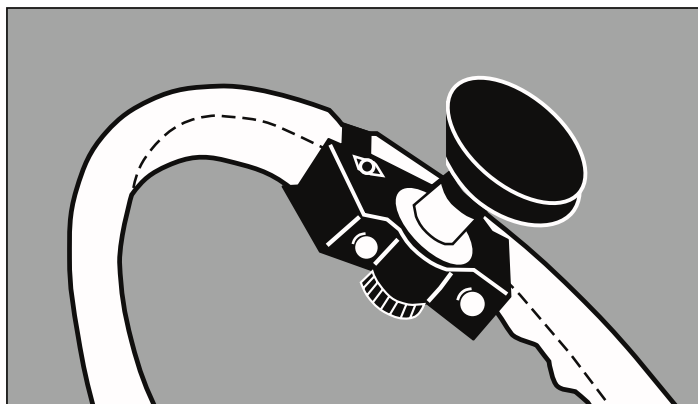
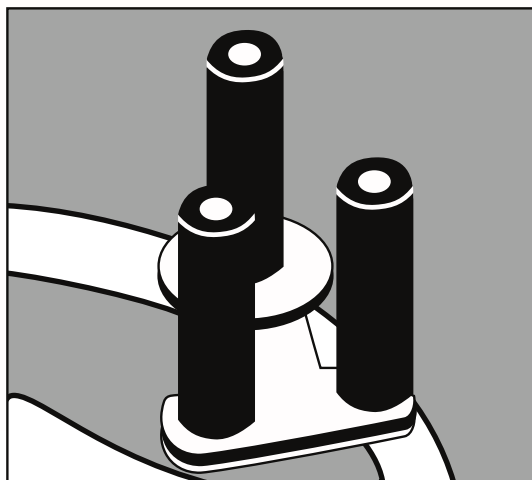
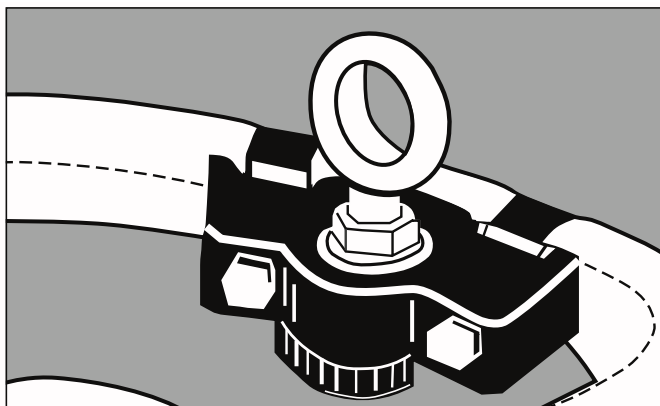
U-cuff

Important

If vehicle has multiple drivers, contact OR-OSHA for regulation information.

Note

Other driving aids are also available, including a “spinner knob” (\$60), a “palm spinner” (\$79), a “tri pin” (\$94) and a “spinner for hook prosthesis” (\$79). One of these devices may meet the needs of people who have disability in their hands or who are amputees.

Spinner knob*Tri pin
(single pin also available)**Palm spinner**Spinner for hook prosthesis*

Jackhammer — hydraulic and thumb pincher

Worker disability

A propane-truck driver injured his right wrist, which required a wrist fusion that left him significantly limited in his ability to use his right hand, wrist, and forearm due to loss of strength and range of motion. He was unable to return to his regular work because he was unable to pull the hose for propane delivery.

Work setting

The worker got a job with a construction company that involved hauling lumber, framing, form setting, driving a dump truck, using a jackhammer to break up concrete before removal, and hand loading chunks of concrete into the bucket of an excavator to remove them.

Obstacle

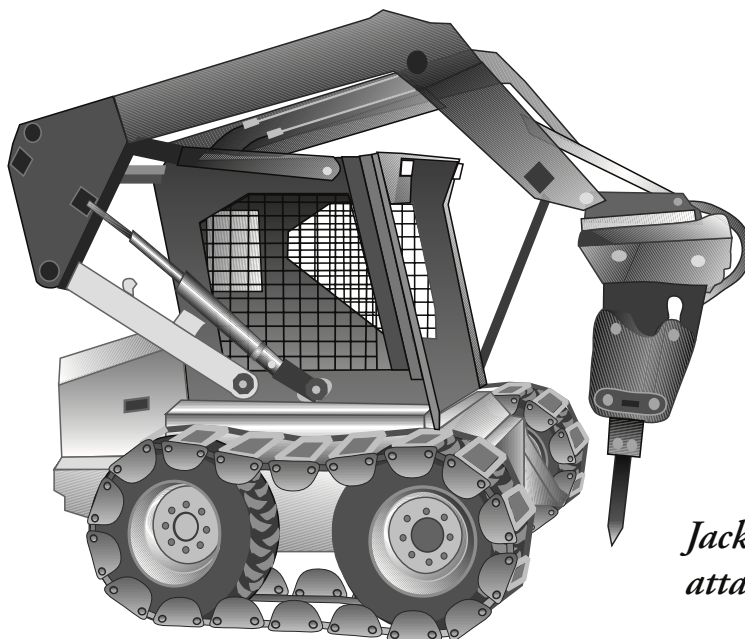
While most of the worker's job duties were within his abilities, using the jackhammer and hand loading chunks of concrete into the excavator bucket were beyond the worker's limitations due to his wrist fusion.

Modification

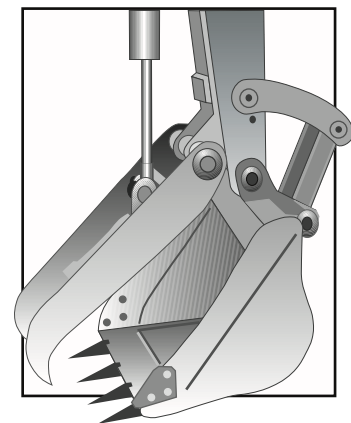
The worksite modification consisted of a hydraulic-jackhammer attachment and a thumb-pincher attachment to the excavator. The thumb-pincher attaches to the excavator bucket to hydraulically push pieces of concrete into the bucket.

Cost of modification

The mounted hydraulic jackhammer cost about \$7,000; cost of fabrication and installation of hydraulic "thumb pincher" for excavator: \$1,800.



Jackhammer attachment



"Thumb pincher"

Jackhammer — pneumatic

Worker disability

A 31-year-old cemetery worker sustained an injury to his low back. The injury resulted in lifting and carrying limits of 50 pounds and an inability to tolerate equipment vibrations.

Work setting

As a cemetery worker, he spends about a third of his workday opening graves using a 90-pound jackhammer.

Modification

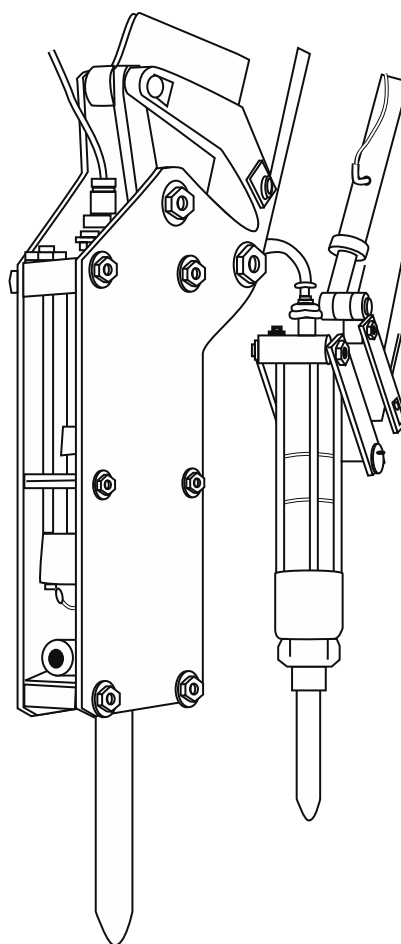
The installation of a pneumatic-jackhammer attachment on the employer's backhoe.

Obstacles

1. Lifting, carrying, and operating a jackhammer that weighs more than 50 pounds.
2. Constant jarring and vibration from manually-operated jackhammer.

Cost of modification

The jackhammer cost about \$2,200.



Post driver/puller — hydraulic

Worker disability

A 36-year-old highway maintenance worker sustained a right-arm injury resulting in a 10-pound lift limit for her right hand and significant limitation of repetitive use of the right wrist.

Work setting

One important job duty for the worker is to install and remove posts that mark the edge of the highway. The worker replaces as many as 25 posts a day. To remove posts, she must manually push and pull the post to loosen it, then pull it from the ground. To install posts, the worker and a helper lift an 80-pound piece of pipe with one end blocked over the top of the post and repeatedly bang the pipe onto the post until it is installed.

Obstacles

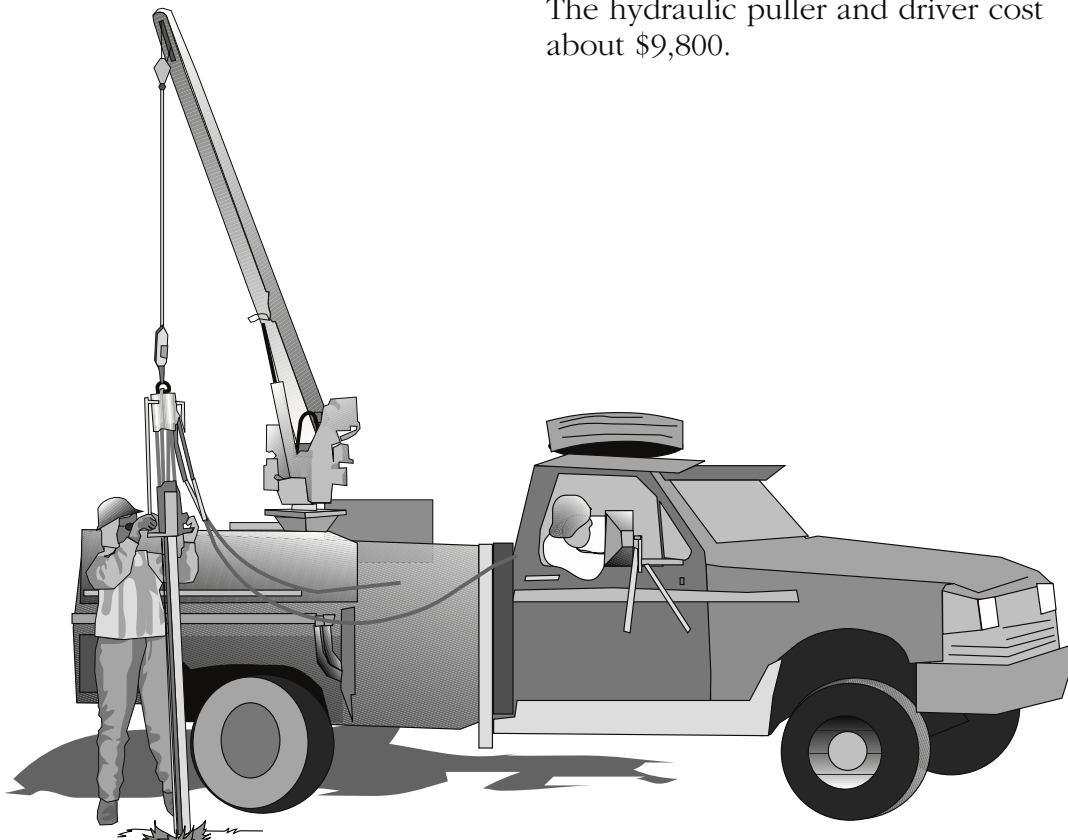
Lifting and forceful repetitive use of the hands are precluded by the worker's permanent limitations.

Modification

A hydraulic post driver and puller do the actual driving and pulling of posts. The hydraulic power unit is permanently installed on a truck. A crane on the truck positions the driver and puller unit.

Cost of modification

The hydraulic puller and driver cost about \$9,800.



Rewind reel — power

Worker disability

A 42-year-old pest-control applicator sustained a shoulder injury from manual cranking of a hose reel. After surgery and recovery, he had lost strength and range of motion in his shoulder.

Work setting

The pest-control applicator applies chemicals through a manual-rewind hose system, which requires cranking.

Obstacle

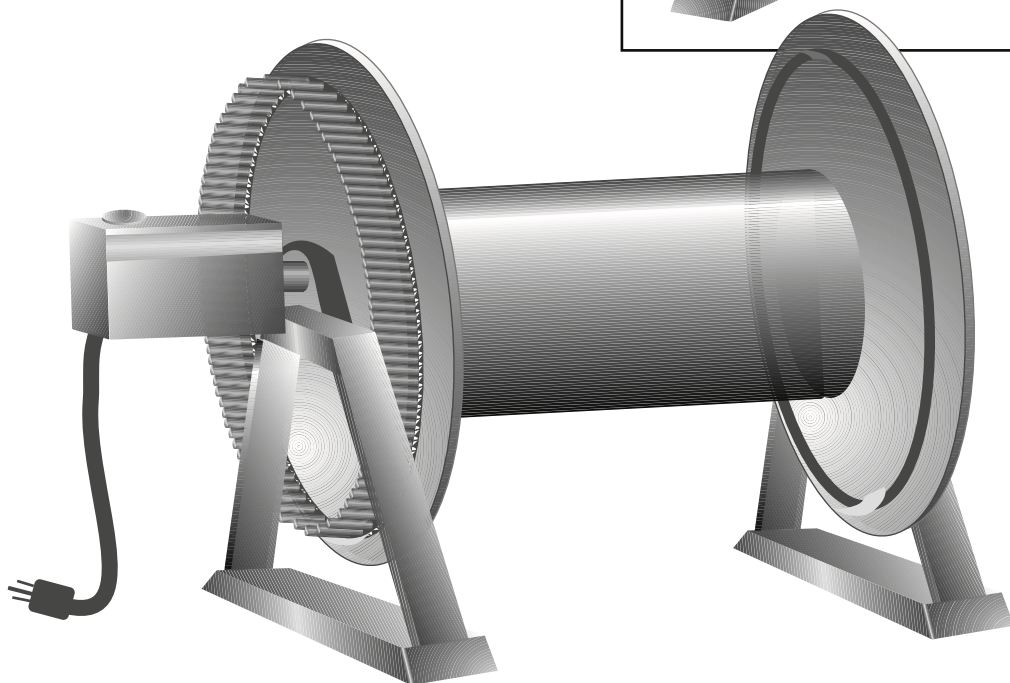
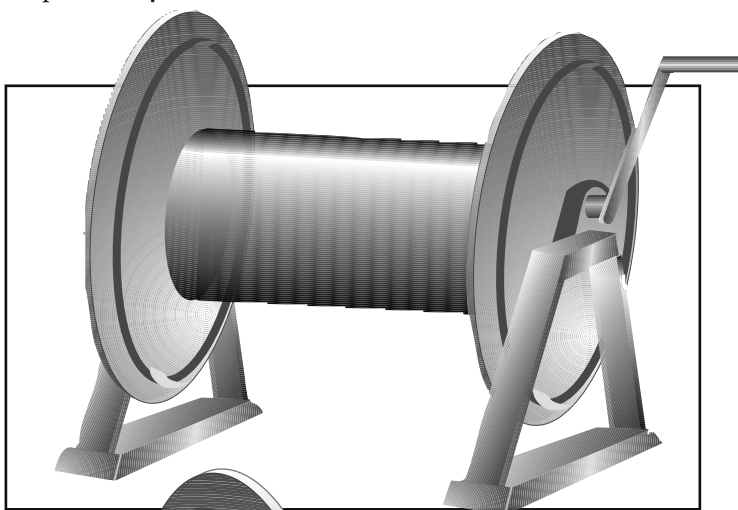
The worker was unable to repetitively crank a spray hose reel.

Modification

The purchase of a power rewind reel.

Cost of modification

The power rewind reel cost about \$800.



Running board — van

Worker disability

A 39-year-old bartender injured her right knee, which required arthroscopic surgery. The injury limited her standing tolerance and ability to climb steps or stairs.

Work setting

The worker, unable to return to her job at injury, returned to work as an activities center supervisor, which requires her to drive clients to and from activities in a van.

Modification

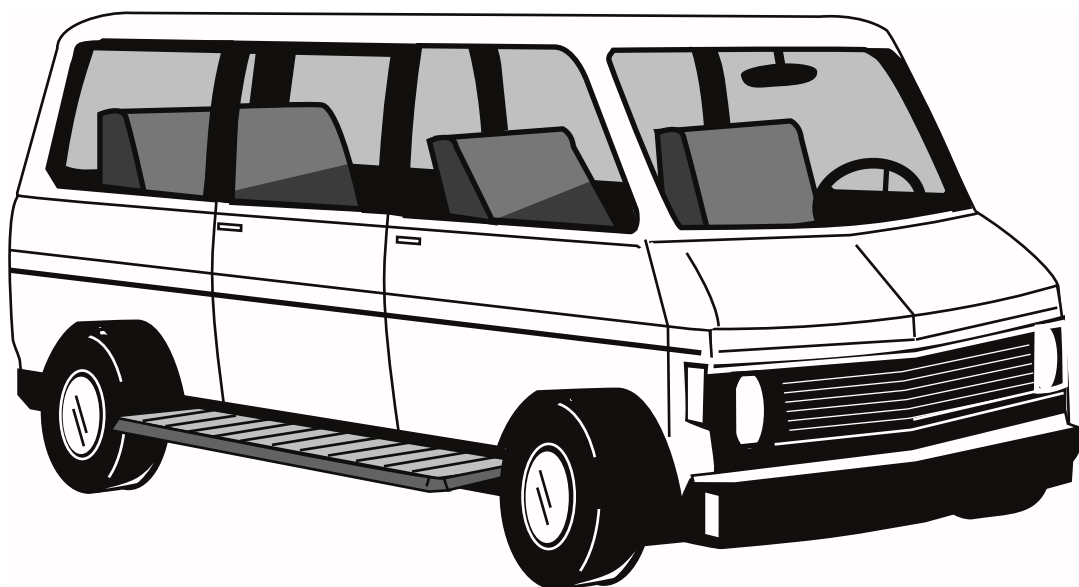
To eliminate the degree of flexion and extension that causes right-knee discomfort, the program purchased a running board (12-inch step).

Obstacles

The degree to which the worker has to flex and extend her knee causes discomfort as she steps into and out of the van.

Cost of modification

The running board cost about \$600.



Spray cab with heater, filters, and rotary mower

Worker disability

A 43-year-old farm worker exposed to hydrogen sulfide was unable to tolerate exposure to pesticides. His industrial disease also resulted in poor tolerance of cold temperatures.

Work setting

The worker performs general farm work in an orchard operation. Among his duties are applying pesticides and mowing grass in the orchards.

Obstacle

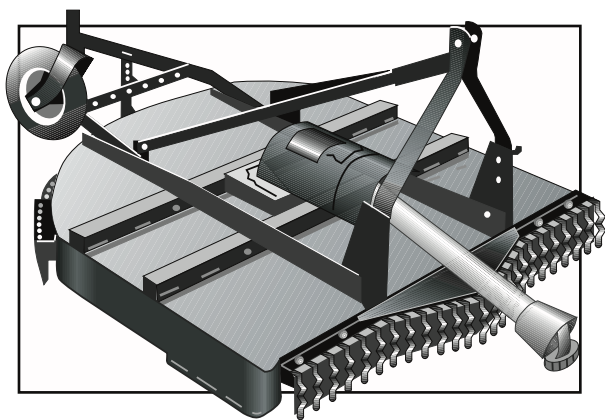
Because of the pesticides in the orchards, the worker couldn't perform any of the orchard duties. He was precluded from all outdoor work during cold weather.

Modification

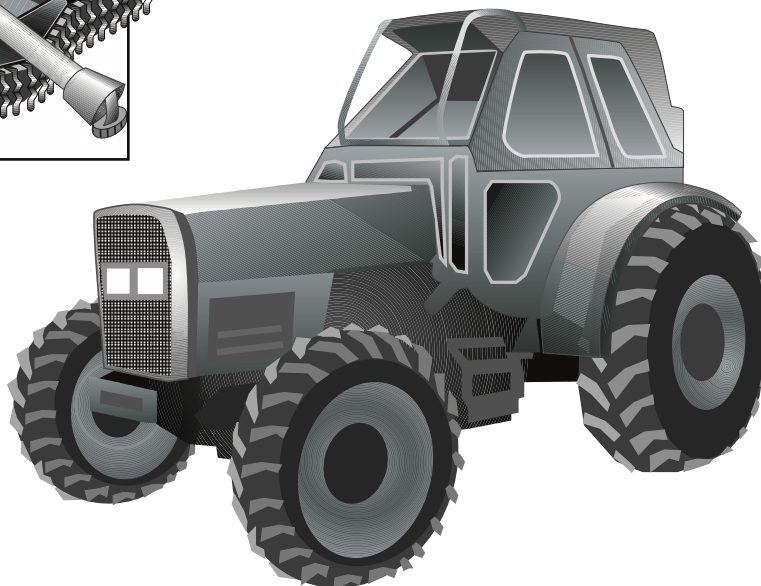
Because of his intolerance to pesticides and cold conditions, the worker's tractor was outfitted with a "spray cab." The spray cab provides a climate-controlled environment for the worker with a special air-filtering system that eliminates exposure to pesticides. The spray cab prevented the tractor from mowing close to the trees, so it was also equipped with an offset rotary mower.

Cost of modification

The spray cab with heater cost about \$14,500 installed; filters, \$2,291; offset rotary mower, \$4,563.



Rotary mower



Spray cab

Tailgate lift — aluminum

Worker disability

A 48-year-old construction worker sustained a severe lower-back injury that required surgery. He was left with permanent restrictions that precluded return to his regular work. He could lift a maximum of 50 pounds on an occasional basis, with no prolonged torso bending or twisting.

Work setting

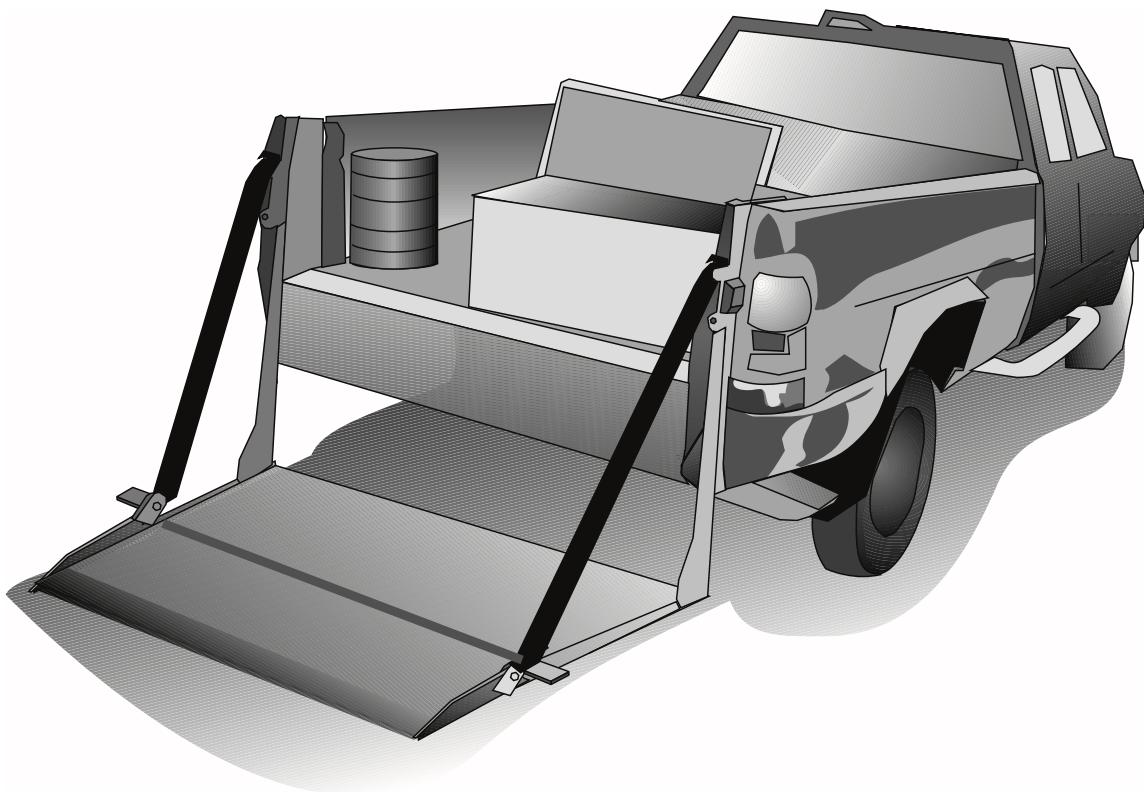
Because the worker was unable to return to his job at injury, he had to seek other work. He got a job as a core tester. However, he was required to handle equipment and core samples that exceeded his 50-pound lifting restrictions.

Modification

An aluminum lift gate allowed the worker to raise items to truck-bed height. Because the lift gate is aluminum, its weight is within the worker's lifting restriction when he raises the deck to its locked position.

Cost of modification

The aluminum lift gate cost about \$2,400.



Tarping system — curtain-side flatbed trailer

Worker disability

A 56-year-old long-haul truck driver suffered a severe left-knee injury in a fall that thereafter precluded climbing on a trailer to tarp and untarp loads.

Work setting

The worker wanted to return to his regular job with a medium-size trucking company that transports a variety of products throughout nine western states. Worksite modification was needed to accommodate the worker's limitations.

Modifications

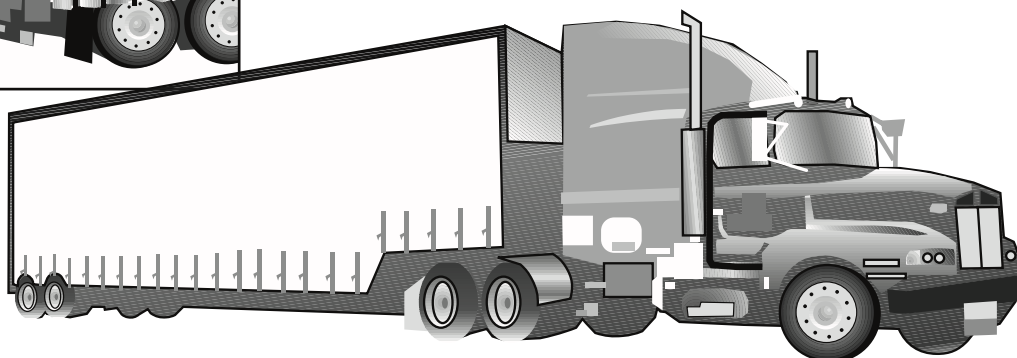
The Preferred Worker Program purchased a curtain-sided trailer that eliminated all manual tarping of loads. These trailers are loaded by forklift from either side. The driver simply snaps the bottom of the curtains from ground level.

Obstacles

The worker had a loss of stability and strength in his knee and was unable to climb onto a trailer to tarp and secure a load. He was also precluded from jumping off a trailer because his knee collapsed under such stress.

Cost of modification

The curtain-side flatbed trailer costs about \$48,000; the Preferred Worker Program contributed the maximum available, \$25,000, and the employer paid the balance.



Tarping system — dump truck

Worker disability

A 26-year-old school-bus driver injured her left ankle and is permanently limited to medium level work, with restrictions on climbing and walking on uneven terrain.

Work setting

The worker found a new job as a heavy equipment operator/dump truck driver. One of her duties is to tarp the loads in the dump truck before hauling them.

Modifications

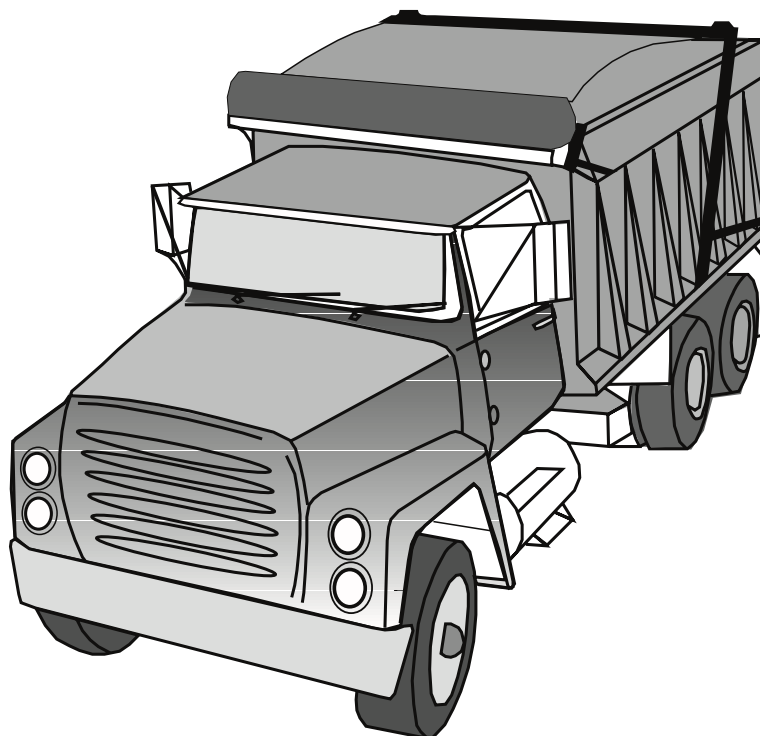
The Preferred Worker Program provided a tarping system for the dump-truck box that can be operated without climbing onto the load. It eliminates lifting and spreading tarps on the load manually.

Obstacles

Manually covering the loads in the truck with tarps and securing the tarps would exceed her climbing and lifting restrictions.

Cost of modifications

The tarping system, including installation, costs about \$1,560.



Tarping system — flat deck

Worker disability

A 48-year-old millworker sustained acute tendinitis of both wrists from extensive use of vibrating tools and repetitive gripping and grasping. He was limited to lifting five to 10 pounds with his left hand and was restricted from strenuous, repetitive gripping or grasping with both hands, which precluded his return to regular employment. He also had climbing restrictions because of his reduced grip strength.

Work setting

The worker found a new job as a truck driver. He hauls various types of loads on flatbed trailers, the tallest of which is about 14 feet. Many of the loads must be tarped to protect them from the elements en route to their destinations. Driving does not require the strenuous, repetitive gripping and grasping he can no longer do.

Obstacle

Tarps to cover the loads weigh from 75-100 pounds. The worker cannot handle the tarps, given his lifting restrictions. Nor can he climb to the top of the loads to position the tarps due to his climbing restrictions.

Modification

The employer acquired a flat-deck tarping system to attach to his trailer. The tarps fold like an accordion, opening at the sides, from either

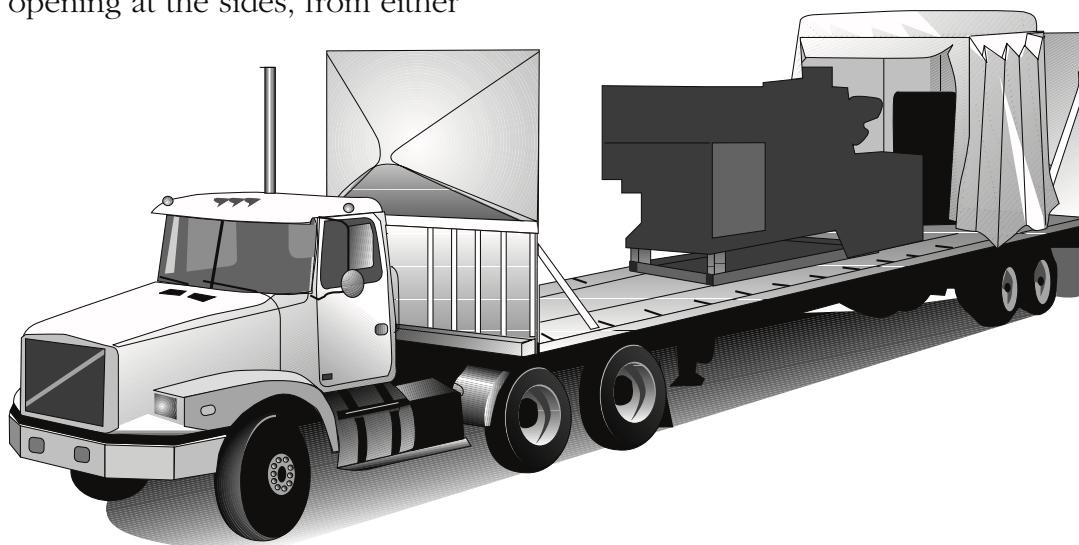
end, or in the back to accommodate various loads and destinations. The system required a modification to the back of the trailer so the worker could fasten and unfasten the straps without climbing.

Cost of modification

The flat-deck tarping system costs about \$12,600, including the modification to the back of the trailer.

Note

This modification may also be a solution for workers who have lifting and climbing restrictions because of back or knee injuries. It can be the preferred option over purchasing a curtain van, because the cost of a curtain van may be prohibitive.



Tire chain system — automatic

Worker disability

A 53-year-old long-haul truck driver was injured in a car accident. The resultant compression fractures of his spine and injury to his left knee limited his sitting tolerance and his ability to squat.

Work setting

Sitting is required for up to four hours at a time. The worker routinely installs and removes chains during winter trips.

Obstacles

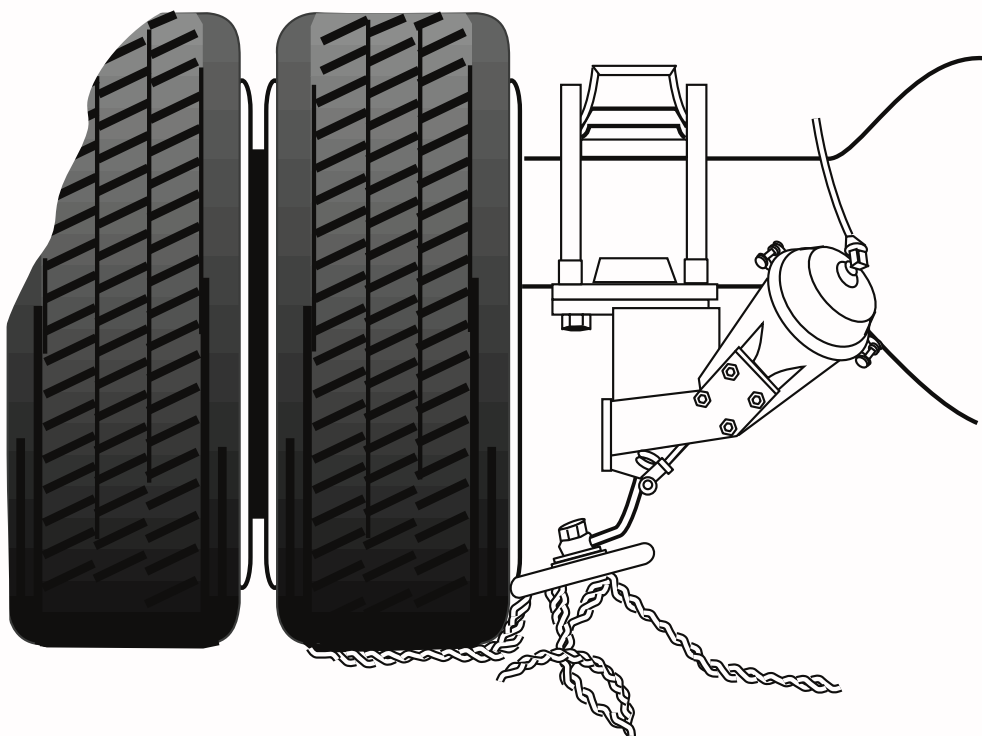
Sitting for prolonged periods of time causes fatigue, and installation and removal of chains requires strenuous physical activity, which includes stooping, crouching, bending, twisting, reaching, pushing and pulling, lifting, and carrying.

Modifications

An automatic chain installation system was installed that can be activated from the cab while the vehicle is in motion. It eliminates manual chain installation. The program also purchased an ergonomic driver's seat. *See Pages 68 and 71.*

Cost of modifications

The automatic tire-chain system costs about \$3,100.



Automotive lift

Worker disability

A 29-year-old automobile mechanic injured his mid back and right hand in a fall. He could lift a maximum 50 pounds only occasionally and could bend, crouch, and crawl occasionally.

Work setting

The worker returned to work as an automotive technician. His duties included diagnosing and repairing fuel-injection systems, spark control and related wiring in the engine, and electrical wiring under the dash.

Obstacle

The worker had difficulty working under the dash for the extended periods necessary to diagnose computer and electrical malfunctions.

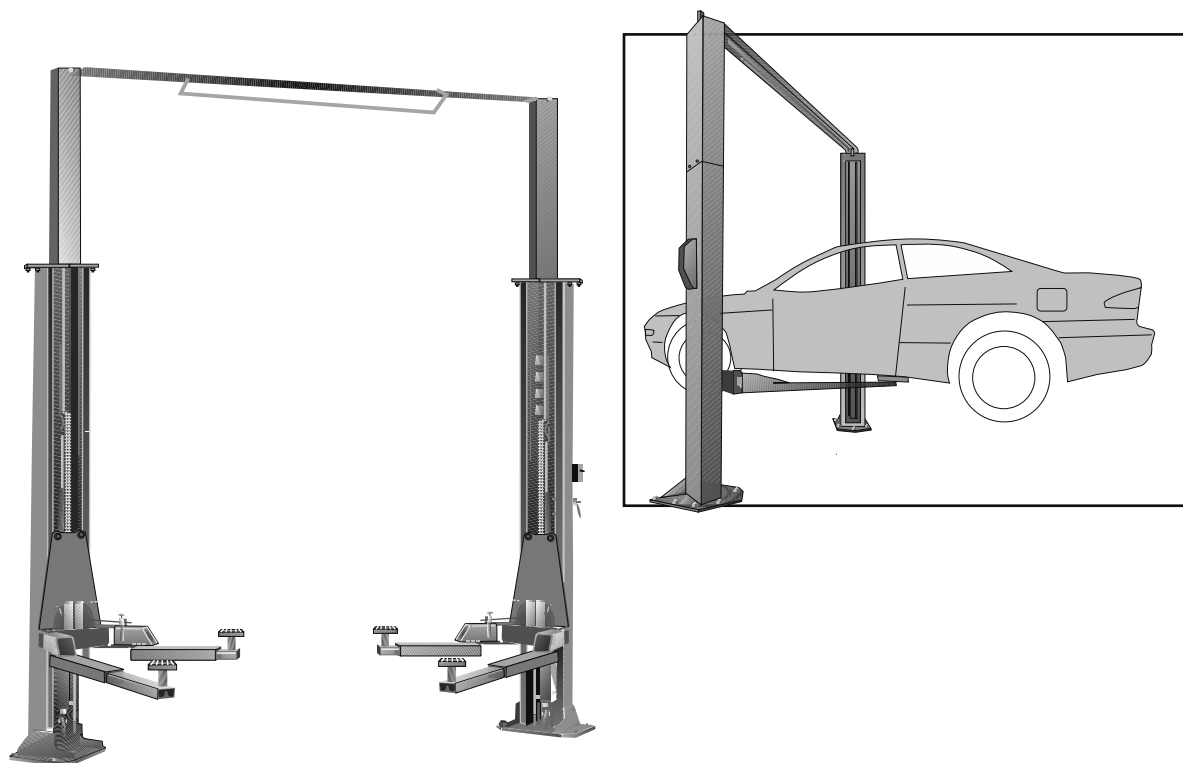
He also had difficulty performing diagnostics under the car, which are usually done by a technician using a creeper or jack stands to raise the car.

Modification

An automotive lift was purchased to lift vehicles to any height necessary for the worker to work without maintaining bent or awkward positions.

Cost of modification

The auto lift cost about \$4,100.



Oil drain caddy — heavy-duty

Worker disability

A 36-year-old machine operator had a lumbar fusion following a lifting accident. He is restricted to occasional forward bending and lifting of not more than 30 pounds. He must change positions frequently.

Work setting

The worker was unable to return to his regular work and found a new full-time job as a lubrication technician with a medium-sized trucking firm.

Obstacle

Changing oil in vehicles required the technician to work in awkward positions to remove drain pans and empty fluids. Oil drain pans weigh 60 pounds, and they had to be pulled from under vehicles, then transported and dumped into a storage receptacle.

Modification

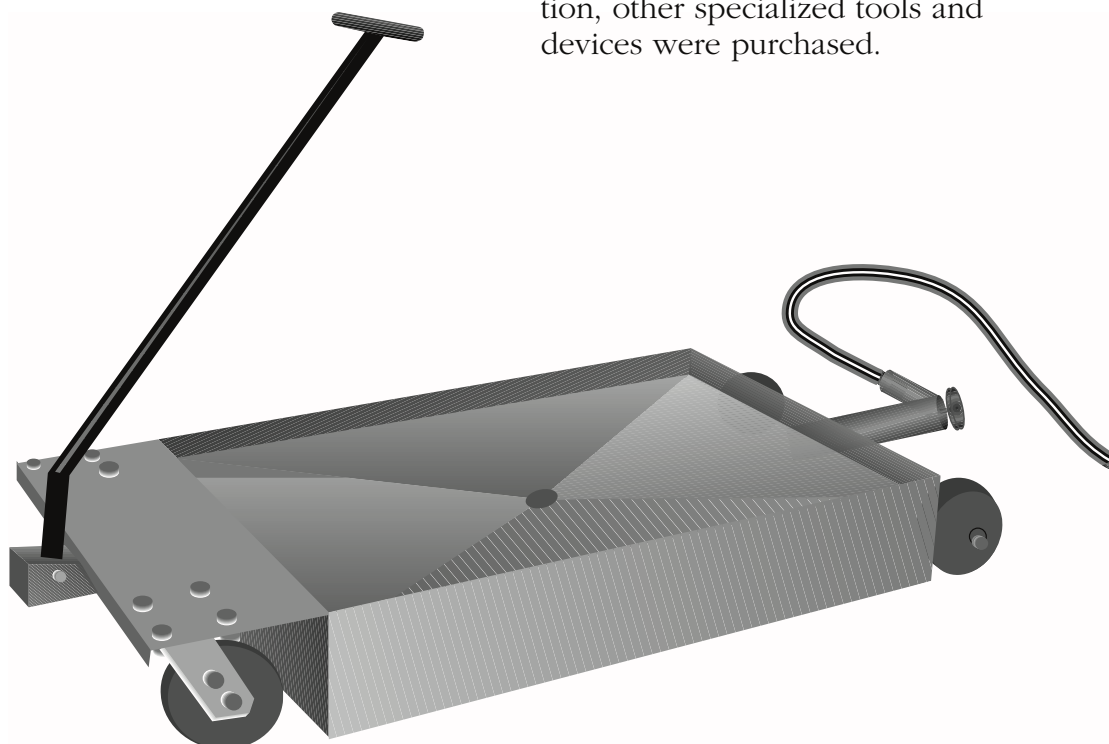
The Preferred Worker Program purchased a wheeled heavy-duty oil drain caddy to collect and transfer used oil. It has an air-operated evacuation kit that eliminates lifting and dumping of oil containers and permits the user to siphon oil directly into a storage tank.

Cost of modification

The heavy-duty oil drain caddy and air-operated evacuation kit costs about \$650.

Note

In addition to the featured modification, other specialized tools and devices were purchased.



Technician lift

Worker disability

A 29-year-old line mechanic fractured a vertebra in his mid back when he fell backwards over an automotive rack. He was left with chronic pain and loss of ability to lift heavy weights and was unable to work in a bent-over posture.

Work setting

The worker found a new job as a driveability technician, allowing him to work with much lighter weights while using his diagnostic skills and mechanical ability. With the use of an automobile lift and diagnostic equipment, he was able to perform many of his job duties without repetitive or prolonged bending.

Obstacle

The worker had to perform tests, repairs, or replacements of automobile components in the engine compartment. These tasks normally require a technician to bend over the front or wheel well of the vehicle repetitively or for extended periods.

Modification

The program purchased a technician lift for the worker, allowing him to work inside the engine compartment while lying on his stomach and eliminating the need for repetitive or prolonged bending. The technician lift has a load capacity of 300 pounds, a padded work surface, and a slide-out drawer in the front to keep tools within reach.

Cost of modification

The technician lift costs about \$500.



Transmission jack, brake-drum handler, wheel dolly, and boom-crane tire lift

Worker disability

A 52-year-old fleet mechanic sustained a lower-back injury in a slip-and-fall accident. After surgery and recovery, he had permanent restrictions from repetitive bending and lifting more than 40 pounds.

Work setting

The worker returned to his regular job, which included changing and repairing tires, transmissions, and brakes.

Cost of modification

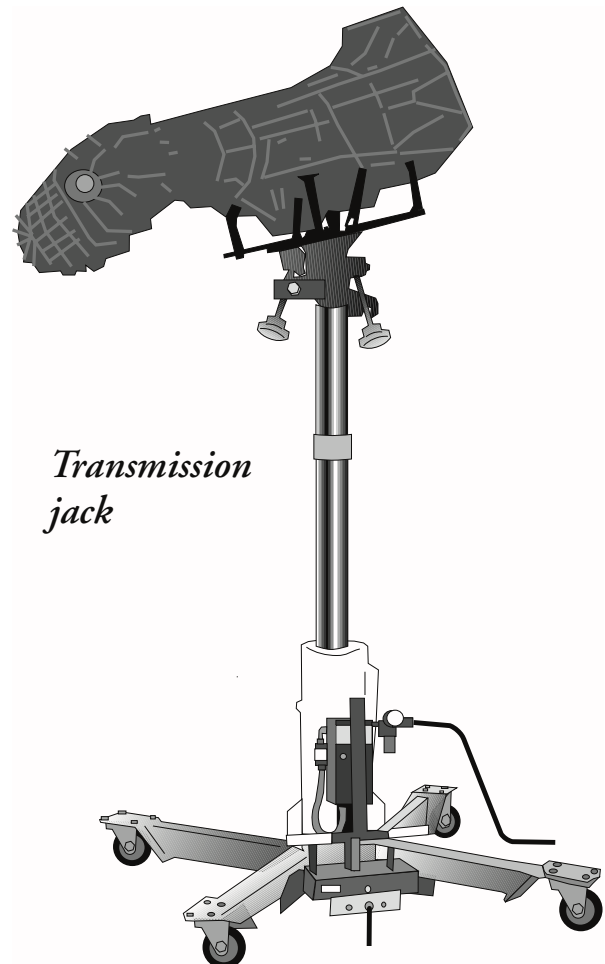
Total cost of modifications was about \$4,700; transmission jack, \$950; brake-drum handler, \$350; wheel dolly, \$875; and boom-crane tire lift, \$2,500.

Obstacle

The worker's lifting restrictions required modifications for lifting and moving heavy tires, brake drums, and transmissions.

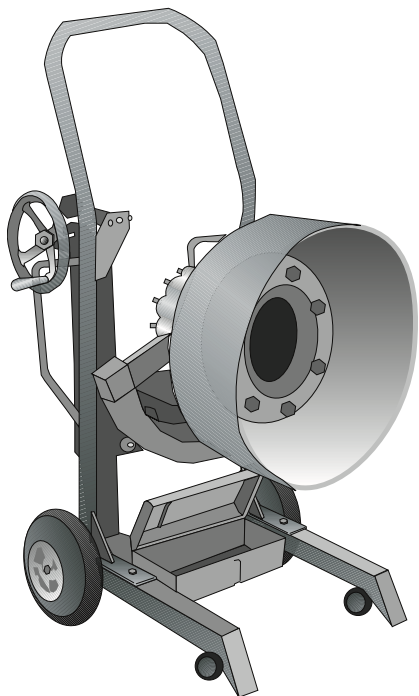
Modification

A wheel dolly allowed the worker to remove tires, move them to the tire-repair area, and re-install them without lifting or carrying. At the tire-repair area, he used a boom-crane tire lift to position the tires. The employer designed an adapter so the boom-crane lift could also be used to lift truck wheels. Heavy transmissions and brake drums were handled with a transmission jack, brake-drum handler and wheel dolly.

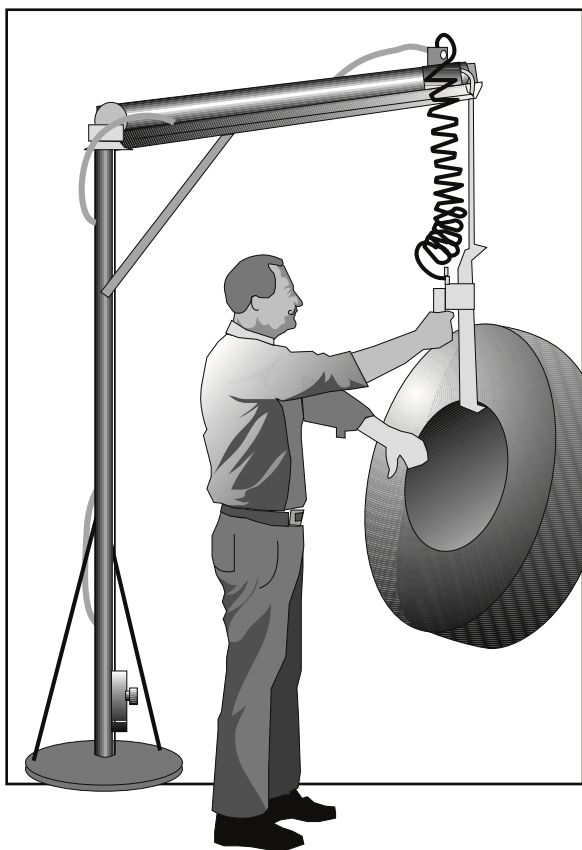
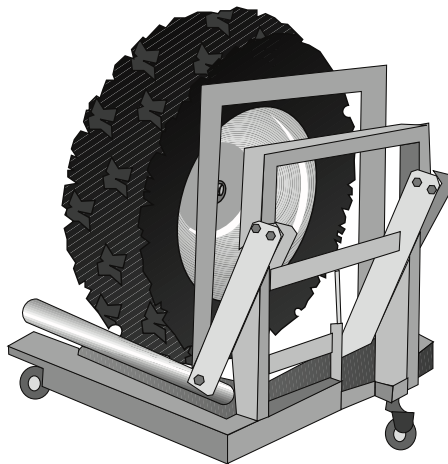


Transmission jack

*Brake-drum
handler*



Wheel dolly



*Boom-crane
tire lift*

Washer/degreaser — automatic

Worker disability

A 24-year-old tree planter sustained an injury to his lower back. The injury limited his stationary standing tolerance and ability to bend at the waist for prolonged periods.

Work setting

The worker was unable to return to his occupation at injury. He returned to work as a starter and alternator rebuilder assistant. This requires the worker to stand for about a quarter of each day, scrubbing parts at a solvent tank, which also requires prolonged bending.

Obstacles

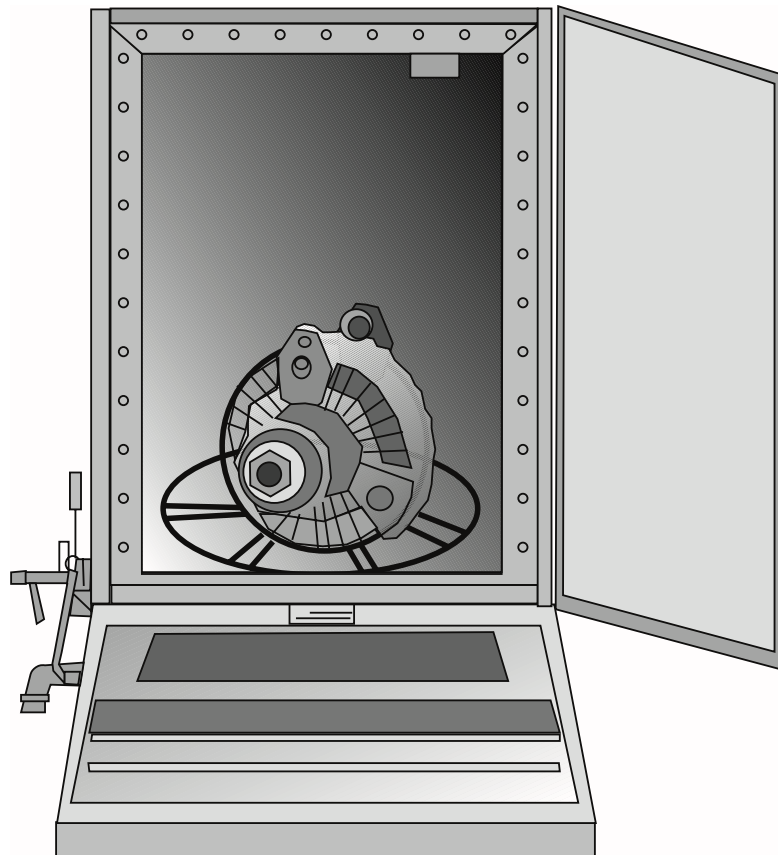
Stationary standing and prolonged bending.

Modification

To eliminate the stationary standing and the prolonged bending, a washer/degreaser was purchased. He now places the parts on a rack that slides into the washer similar to a home dishwasher. He no longer has to manually scrub the parts.

Cost of modification

The automatic washer/degreaser costs about \$3,300.



All-terrain vehicle

Worker disability

A 36-year-old farmhand suffered injury to his left knee when he stepped in a hole in a field.

Work setting

The worker's duties on the farm include checking and setting irrigation equipment, which require him to climb hills and travel through muddy terrain. The employer's two-wheel-drive all-terrain vehicle frequently gets stuck, requiring the worker to walk substantial distances to get help.

Obstacle

The worker can no longer walk substantial distances or over rough terrain.

Modifications

A four-wheel-drive all-terrain vehicle was provided to allow him to make his rounds without getting stuck. A winch on the all-terrain vehicle provides added assurance that the worker will be able to free the vehicle should it get stuck.

Cost of modification

The four-wheel-drive all-terrain vehicle with winch, license, registration, and title costs about \$6,550.



ATV with winch and tractor with balefork

Worker disability

A 48-year-old ranch worker lost his right foot in a trailer-hitch accident, resulting in loss of the ability to do prolonged standing, walking on uneven terrain, and lifting and carrying more than 35 pounds.

Work setting

The worker, with the assistance of a private vocational rehabilitation counselor, found an opportunity to continue working if substantial modifications could be made to his regular work. The new employer was willing to modify his ranch operation to accommodate the worker's permanent limitations. Bales of hay were normally handled manually, but the rancher converted the hay operation to rolls weighing approximately 1,000 pounds that could be handled with equipment.

Obstacle

The ranch consists of 1,000 acres of hilly terrain. The worker can no longer walk on uneven terrain for more than a short time. He can't shovel stalls or load and unload hay bales by hand because of his lifting and carrying limitations.



Four-wheel ATV

*Winch accessory
on some models*

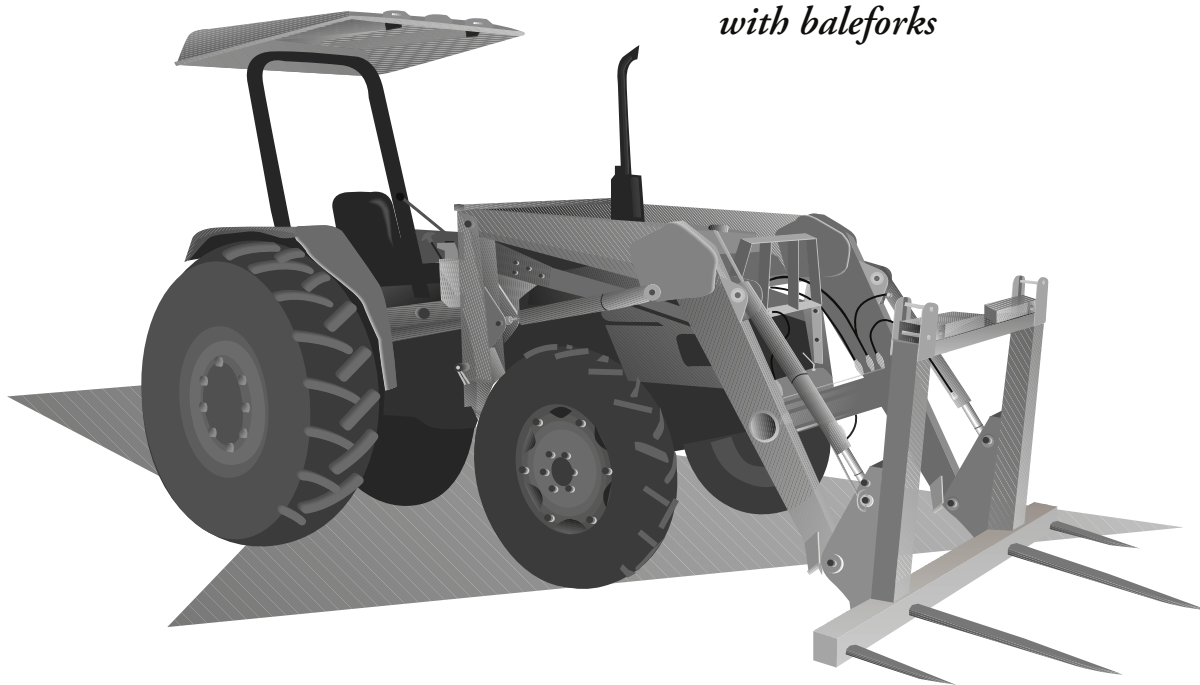
Modifications

The program purchased a four-wheel-drive all-terrain vehicle with a winch. This eliminated walking on uneven terrain and allowed the worker to move ailing animals without exceeding his permanent limitations. Also, the program purchased a four-wheel-drive option and attachments for the tractor that allow the worker to clean stalls and handle hay rolls mechanically. A three-point hitch was purchased for a different tractor for towing a livestock trailer. The worker can hitch the tractor to the trailer without getting off the tractor, eliminating frequent climbing and the physical demands of manipulating the trailer to hitch to the tractor.

Cost of modification

The four-wheel-drive ATV with winch costs about \$17,000; the tractor upgrade to four-wheel-drive, \$4,700; loader, basket, and bale-fork attachments for the tractor, \$5,779; and custom-fabricated three-point hitch, \$90.

*Four-wheel-drive tractor
with baleforks*



Cart with cargo — electric

Worker disability

A 55-year-old housekeeper in a nursing home sustained a lower-back injury resulting in a 20-pound limit on lifting, carrying, pushing, and pulling.

Work setting

The worker was unable to return to her occupation at injury. She returned to work as a plant nursery supervisor where she repetitively pushes a cart of nursery stock from one greenhouse to another.

Modification

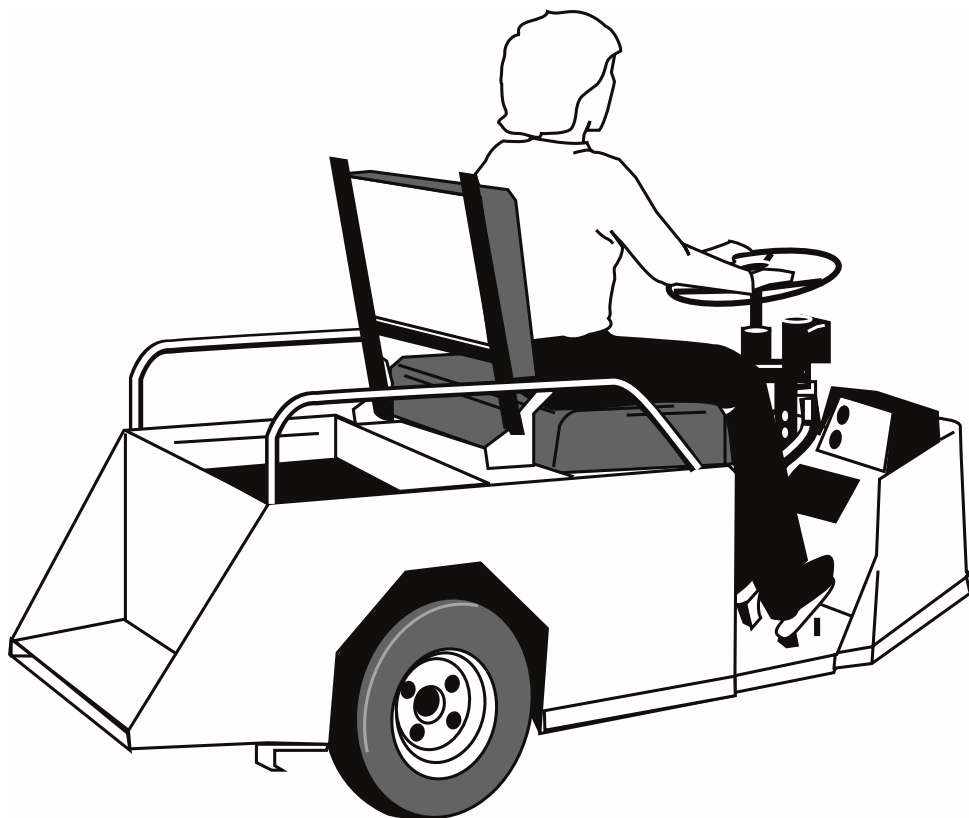
The purchase of a used three-wheeled electric cart with cargo space.

Cost of modification

The three-wheeled electric cart cost about \$2,200.

Obstacle

The push/pull force to move the cart when fully loaded (approximately 125 pounds) exceeds her capability.



Scooter — electric

Worker disability

A 39-year-old worker broke both of her ankles and feet falling from a ladder while employed as a merchandise flow manager in a large department store.

Work setting

The worker returned to work with the employer at injury as a customer service manager. The job requires her to keep aislesways clear and to ensure that shelves are properly stocked. The job also requires data entry.

Obstacles

The worker may walk no more than one hour during the workday. She may no longer carry any weight, and she cannot climb stairs. She must work at the computer, which is located upstairs.

Modifications

A three-wheeled electric scooter was purchased for the worker. A computer monitor and keyboard were installed in a downstairs office to allow the worker to use the computer without having to climb stairs.

Cost of modifications

The modifications cost about \$2,344; three-wheeled scooter, \$1,575; and computer terminal, \$769.



Sweeper

Worker disability

A 51-year-old mausoleum maintenance worker fractured his left foot while handling a heavy marble slab, after which he could no longer walk or stand more than one hour at a time. He could lift up to 35 pounds occasionally.

Work setting

The worker performed general housekeeping and maintenance of the mausoleum. Cleaning tasks included sweeping floors in many long hallways.

Obstacle

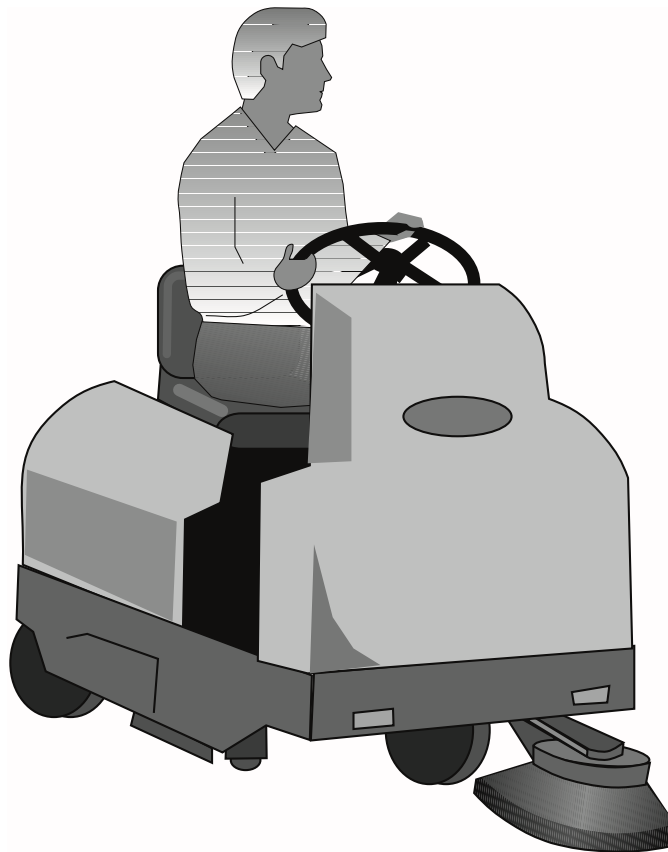
Sweeping several miles of hallways required the worker be on his feet beyond his restrictions on some days.

Modification

A riding power sweeper was provided to reduce standing and walking to less than one hour at a time.

Cost of modification

The riding power sweeper cost about \$10,200.



Utility tractor — compact

Worker disability

A 40-year-old construction worker crushed his right arm in a 15-foot fall, resulting in loss of strength and range of motion in his right forearm and elbow.

Work setting

The worker found a new job as a foreman with a construction firm that builds houses and apartments.

Obstacles

Because the worker is right-handed, the loss of strength and movement in his right arm presented obstacles to returning to construction work. He couldn't shovel and dig by hand, use tools repetitively, or push and pull a wheelbarrow.

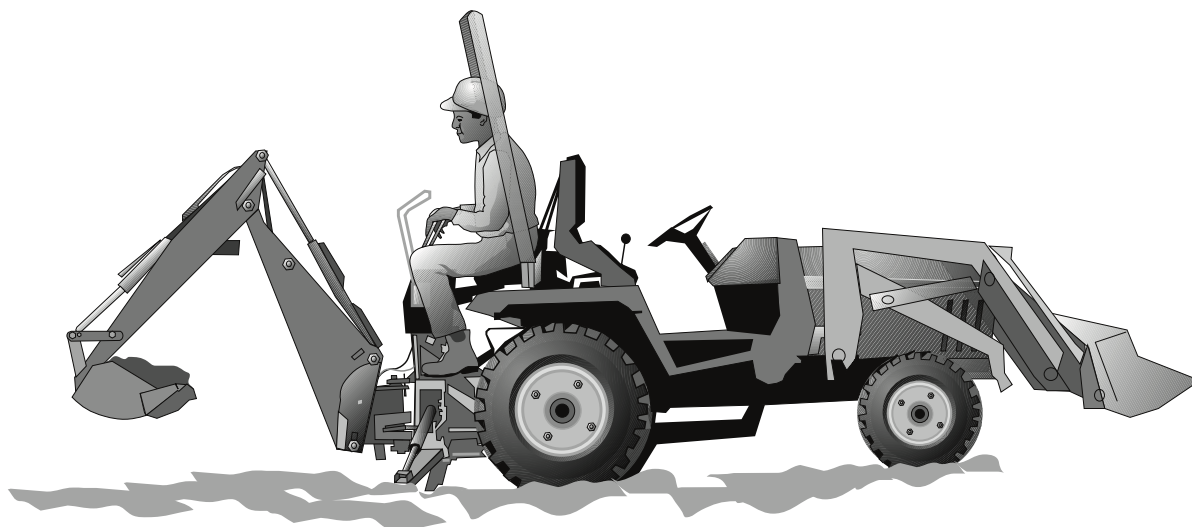
Modifications

The program purchased a compact utility tractor with backhoe, loader, and bucket attachments. This elimi-

nated all hand digging, shoveling, and placement of materials. The model the worker and re-employment consultant chose had power steering and an automatic transmission to minimize the strength and number of movements needed to operate the tractor. The program also purchased a trailer so the worker could move the tractor from site to site.

Cost of modification

The modifications cost about \$20,800; \$19,000 for a four-wheel-drive tractor with automatic transmission, power steering, and attachments; and \$1,800 for a trailer.



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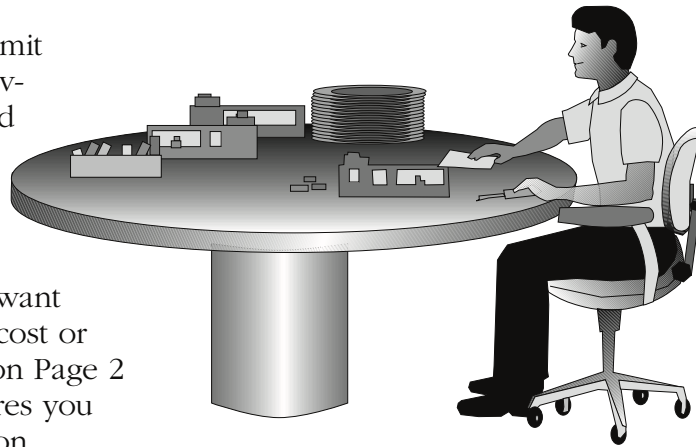
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Workstations

A workstation can enhance or limit a worker's comfort and productivity. When a worker has sustained an injury, characteristics of the workstation often become even more critical. Often simple modifications can make a world of difference. You may want to review the list of simple low-cost or no-cost worksite modifications on Page 2 for some quick and easy measures you can take to improve a workstation.



This section gives a sampling of workstation modifications that can be purchased. Tips for creating an adjustable workstation can be found on Page 111. Tips for creating a comfortable computer workstation are on Page 119.

Matting — anti-fatigue

Worker disability

A 42-year-old materials handler sustained a lower-back injury that resulted in lifting restrictions and limited tolerance for both sitting and standing.

Work setting

The worker was unable to return to his job at injury. His employer offered him a machine operation job that could be done either sitting or standing and did not require lifting. While sitting, he needed good lower-back support.

Modification

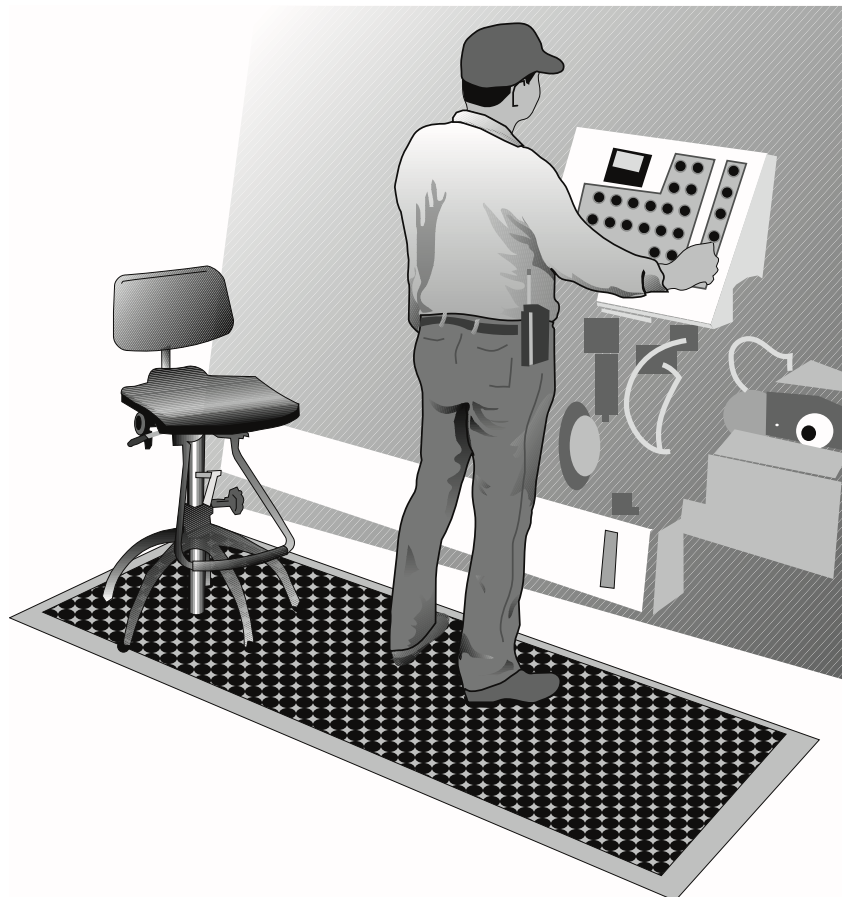
An ergonomic chair, designed for an industrial environment, was purchased to provide lower-back support. Anti-fatigue mats were provided to cushion the floor, which increased the worker's tolerance for and comfort in standing.

Obstacle

The worker experienced lower-back pain with either sustained sitting or standing. He needed to alternate work postures.

Cost of modification

The anti-fatigue mat cost \$240 and the ergonomic chair cost \$670.



Matting — dry-deck, anti-fatigue

Worker disability

A 30-year-old dairy farmer injured his back when he slipped on a wet concrete barn floor. As a result of the injury, the worker has limited standing tolerance.

Work setting

The worker is required to stand for three or four hours a day during milking.

Obstacle

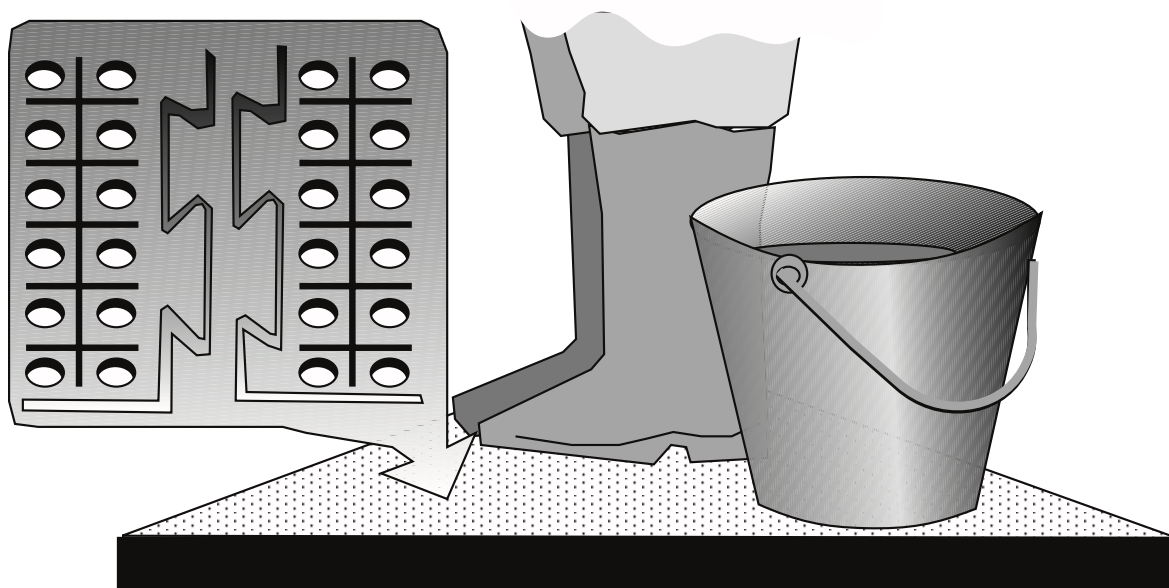
Standing on concrete.

Modification

The program purchased rubber anti-fatigue matting to absorb shock to the back, resulting in an increase in the worker's standing tolerance. Perforations in the matting allow drainage to minimize the risk of slipping and falling.

Cost of modification

The anti-fatigue matting cost \$2,200.



Multi-phone system

Worker disability

A 29-year-old security guard received a left-knee injury, resulting in surgery that reduced his standing and walking tolerance.

Work setting

The worker was unable to return to his occupation at injury. He returned to work as an operations assistant for a tool company. This requires the worker to stand six hours a day at a counter, four hours of which is walking to co-workers' desks to answer telephones.

Obstacles

Limited standing and walking.

Modifications

The program purchased a stool to eliminate continuous standing at the counter and a multi-phone system to eliminate the need for the worker to walk to another employee's desk to answer the telephone.

Cost of modifications

The multi-line phone system costs about \$550.



Telephone headset

Worker disability

A 57-year-old office-equipment repairer severely injured her left shoulder, which required two surgeries and a change of occupation. She has limited range of motion in her shoulder and neck.

Work setting

The worker was placed in an administrative job in a business office. Her new job involves extensive telephone work. The worker frequently tilts her head and raises her left shoulder to hold the telephone receiver and keep her hands free.

Modification

The purchase of a telephone headset allowed the worker to keep her neck and shoulder in a neutral position, while freeing her hands.

Cost of modification

The telephone headset costs about \$146.

Obstacles

Repetitive lateral flexion of the neck and raising of the left shoulder to cradle the telephone receiver.



Creating a sit/stand workstation

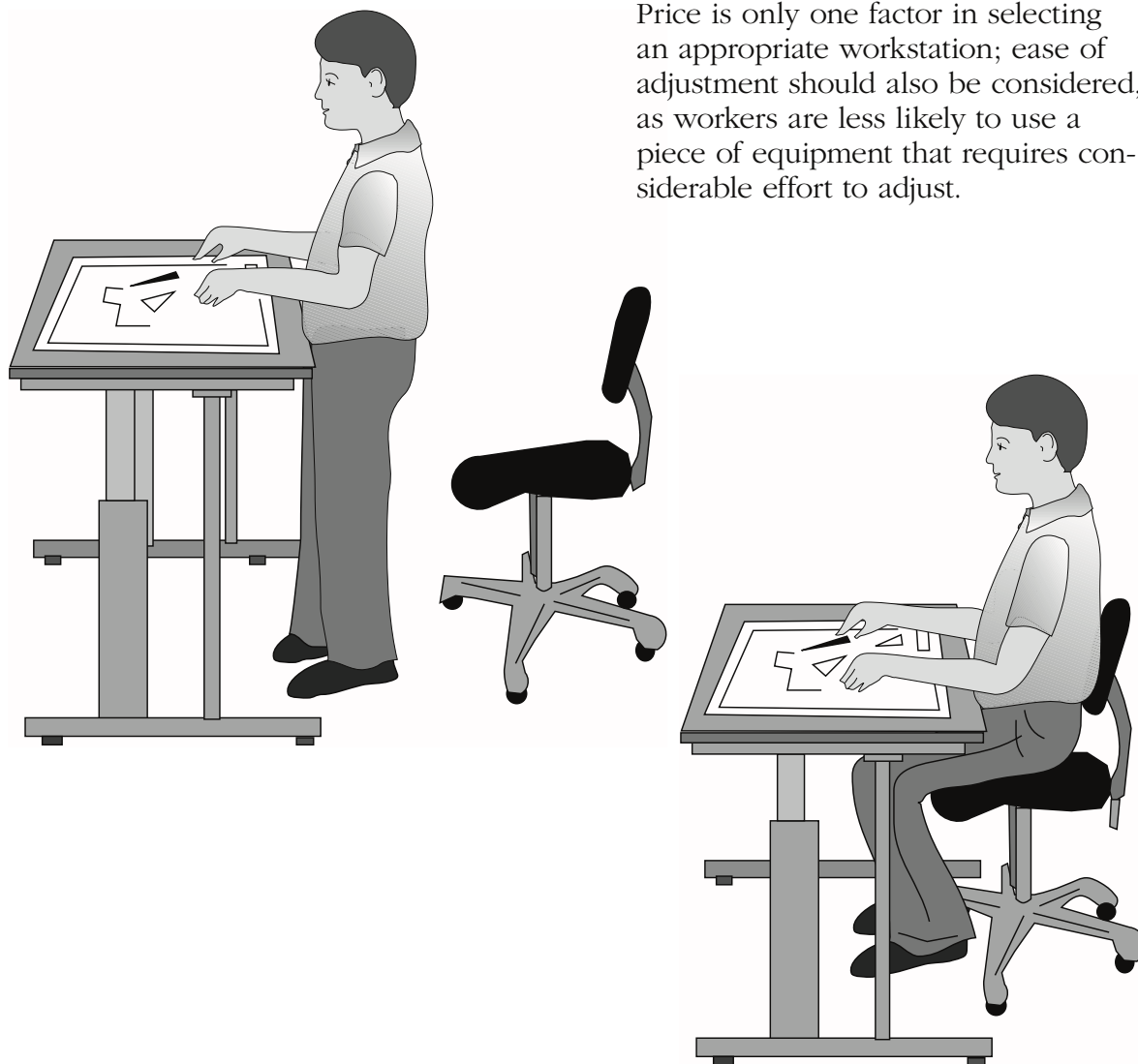
A sit/stand workstation can be the answer to accommodating a worker who must alternate between sitting and standing throughout the workday.

There are two ways to create this type of workstation: One method is to use a standing-height desk in a fixed position and a technician's chair. The desk must be at the correct height for the worker. It is important to have a flat footrest under the workstation or attached to the technician's chair.

There are commercial standing-height workstations, but none of them resembles a standard desk with drawers. They can be assembled from modular units that allow height-

specific positioning. Many ergonomic chairs can be made into technician chairs by adding extension shafts and foot rings. Not all workers are physically able to get on and off a high chair. This solution may not work if the workstation is shared by two or more workers.

The second way to create a sitting/standing workstation is to purchase a desk or table that moves up and down and a standard ergonomic chair. Some workstations adjust with a crank mechanism and others adjust electrically, at a touch of a button. Manually adjustable workstations can be purchased for a few hundred dollars; electrically adjustable models range in price from \$1,100 to \$3,500. Price is only one factor in selecting an appropriate workstation; ease of adjustment should also be considered, as workers are less likely to use a piece of equipment that requires considerable effort to adjust.



Desk — height-adjustable

Worker disability

A 47-year-old woman developed bilateral carpal tunnel syndrome in her job as a data-entry clerk. She was permanently restricted from sedentary work and repetitive hand and arm motions. Her physician said she could not return to her regular work.

Work setting

The worker accepted a secretarial position with a temporary-employee-placement business. Her duties included answering the phone, routing messages, greeting customers, interviewing individuals for temporary placement, data entry and retrieval, and producing reports.

Obstacles

Working at a non-adjustable desk and a non-adjustable computer station that were too low caused severe stress postures of her upper extremities and cervical spine.

Modification

A height-adjustable workstation was provided.

Cost of modification

The adjustable workstation cost about \$3,500.



Desk — standing height

Worker disability

A 24-year-old stage technician had a lower-back strain.

Work setting

He returned to work as a computer-aided drafting technician, operating a computer keyboard and mouse on a large stylus.

Obstacles

The worker is released to sedentary work, which limits him to sitting for one hour at a time, up to four hours a day. The job requires sitting at the computer for eight hours a day.

Modifications

The program provided a standing-height desk with a foot rest and an adjustable tray large enough to accommodate the keyboard and stylus. An ergonomic chair on an extended shaft with foot ring was also provided. This allows the worker to sit or stand at will to perform the job.

Cost of modifications

The modifications cost about \$2,699; desk, \$1,976; and ergonomic chair, \$723.



Drafting table with adjustable height and tilt

Worker disability

A 43-year-old construction worker injured his back and was unable to return to his regular work. After several surgeries, he had permanent restrictions that included sitting no more than one hour at a time, standing five to seven minutes at a time, and walking 15 minutes at a time. He could lift, carry, push, or pull a maximum of 20 pounds occasionally and bend, crawl, and reach above the shoulder occasionally.

Work setting

The worker was retrained as a construction estimator. The new job was in an office setting and required no significant lifting. Much of his time was spent doing “take-offs,” which consisted of measuring lines and areas on large blueprints to calculate construction costs.

Obstacle

The worker worked at a flat, fixed-height table that required prolonged standing, bending, and forward-reaching over the blueprints.

Modification

The worker needed an electric, adjustable-height, adjustable-tilt drafting table for working with blueprints. This table allowed him to quickly adjust the height and tilt of the table. Now he can change work postures frequently and move the blueprints into position to avoid bending and working above the shoulder.

Cost of modification

The electric, adjustable-height, adjustable-tilt drafting table costs about \$2,500.



Sit or stand workstation

Worker disability

A 44-year-old logger sustained an injury to his hip resulting in a sitting limitation of an hour and a half hour at a time.

Work setting

The worker was unable to return to his occupation at injury; he returned to work as an insurance adjuster, which meant sitting for two hours continuously and up to six hours a day.



Obstacle

Sitting in excess of an hour and a half.

Modification

The purchase of an electrically adjustable versatility table that allows the worker to adjust the height for a sitting or standing work position.

Cost of modification

The versatility table costs about \$1,100.



Workbench — adjustable

Worker disability

A 43-year-old man suffered a bilateral inguinal hernia while working as a warehouse foreman. He also had been operated on for a knee injury in a previous job in the construction industry. After surgery for his hernias, he had permanent restrictions of no more than occasional torso bending, no kneeling or squatting, and no lifting more than 50 pounds on an occasional basis.

Work setting

The worker could not return to his regular work without substantial worksite modification. His job duties included handling all sizes of furniture. He maneuvered them onto a workbench or shifted his body posture to inspect and repair them. This job required heavy lifting and frequent torso bending, squatting, and kneeling.

Modification

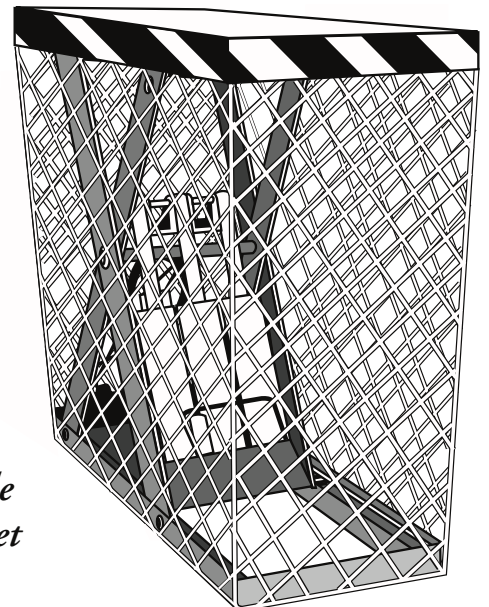
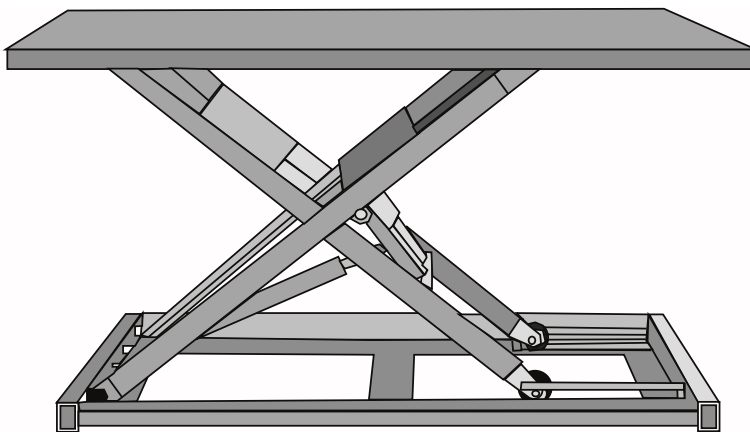
An electric scissors-lift enabled the worker to position the furniture at a height that eliminated torso bending, squatting, and kneeling.

Cost of modification

The electric scissors-lift cost about \$3,000.

Obstacle

The existing workstation was a stationary-height workbench. It required him to perform awkward heavy lifting or awkward body postures. These work tasks exceeded his injury-caused permanent limitations.



*Also available
with safety net*

Workbench — electric carousel

Worker disability

A 46-year-old worker injured his left arm and wrist, which required a bone graft from his hip to fuse his wrist. Due to complications, he now has a standing limitation with decreased lifting and carrying ability.

Work setting

The worker was unable to return to his job at injury. He returned to work as a production assembler. He strips motors and seals carburetors, which involves constant movement to retrieve tools and parts. Modification of the workstation was necessary to permit the worker to work at normal or near-normal levels of productivity.

Obstacles

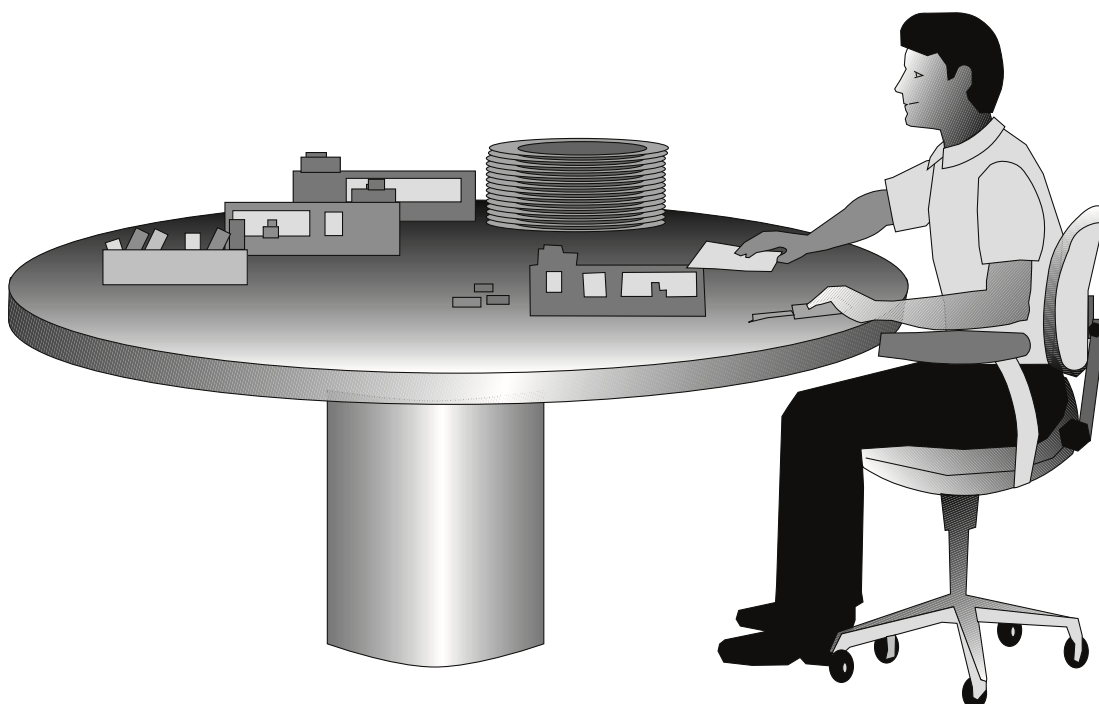
Two activities associated with this job exceeded the worker's physical capabilities standing and moving about and lifting and carrying motors.

Modifications

To eliminate standing, a chair was purchased. Lifting and carrying was eliminated by fabricating an electric-carousel workbench. The seated worker electrically rotates his tools and motors to him.

Cost of modifications

Cost of the electric carousel workbench is about \$1,000.



Workbench — mobile

Worker disability

A 40-year-old production worker injured his lower back, left knee, and right leg while working in a paper mill. He was permanently restricted from lifting more than 50 pounds, prolonged or repetitive bending, twisting, kneeling, standing, or walking.

Work setting

The worker became a maintenance worker in a correctional facility. He performs routine maintenance that includes replacing door-lock mechanisms of inmate cells, replacing defective plumbing components, doing landscape maintenance, and repairing walls, floors, doors, and masonry. The correctional facility has several buildings, which requires the worker to carry equipment and tools between buildings to perform routine tasks.

Obstacle

Because there aren't workbenches at most of the work sites, the worker had to perform tasks at floor level, which involved prolonged bending and kneeling. The tools and equipment required for some tasks weighed more than he could carry within his restrictions.

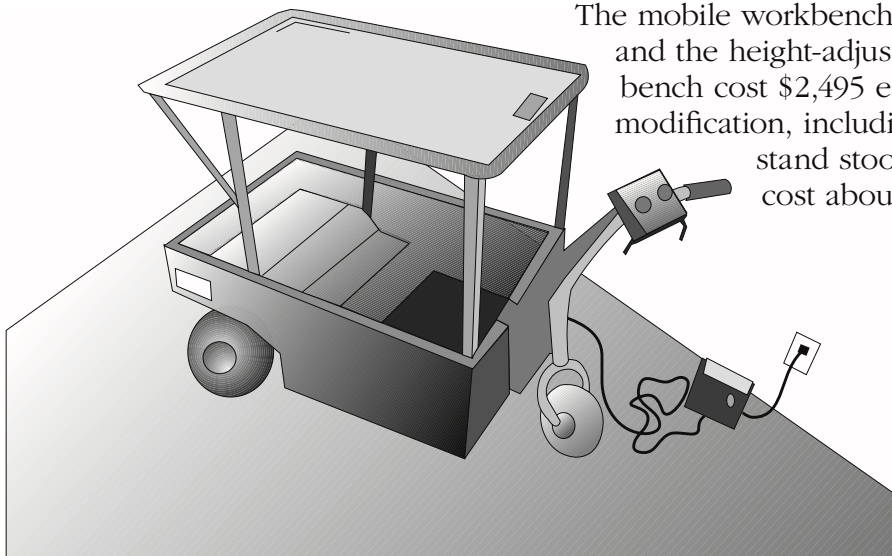
Modification

The Preferred Worker Program, in collaboration with the vendor, developed a battery-powered mobile workbench that carries his tools and equipment to the job location. The worker can perform tasks without bending or squatting for prolonged periods because the workbench has a work surface that allows him to work in a neutral position.

The existing low counter that served as a workbench was replaced with two height-adjustable workbenches at which the worker can either sit or stand to work. These purchases, along with a sit/stand stool and a duplicate set of tools, have allowed him to perform his job within the permanent limitations caused by his injury.

Cost of modifications

The mobile workbench with charger and the height-adjustable workbench cost \$2,495 each. The total modification, including the sit/stand stool and the tools, cost about \$10,000.



Selecting equipment for workstation computer

Display screens

When viewed on the display screen, characters should not have a perceptible flicker or waiver. Letters and symbols should not be distorted or appear to melt together. Character size should be sufficient for the viewing distance (ANSI/HFS-100, 1988). In addition, workers should be able to adjust program controls to increase the size of the characters to make reading easy. The screen should have brightness and contrast controls and the user must know how to adjust them.

Color is secondary to contrast and clarity of the display, but low-contrast combinations must be avoided. Regular screen cleaning is necessary to maintain clarity.

When adjusting screen height, the topmost active line of the display should be at or slightly below the user's line of vision. The topmost active line is the first line that is regularly used, not the top line of the status bar or command line. The viewing distance between the user's eyes and the screen should be 16-29 inches when the neck is in the neutral position. Bifocal and trifocal users may want to position monitors lower on the work surface to avoid tilting their heads to read through the bottom portion of their lenses. Screens that swivel horizontally and tilt or elevate vertically enable the operator to adjust the screen for the best viewing angle. Mounting a video display monitor on an adjustable arm that allows movement in all directions is the most efficient way to provide flexibility, create workstation space, and allow more than one operator to use a workstation.

Keyboards

Choose a keyboard that is detached from the display screen to allow independent angle adjustment and positioning. The keyboard should have a thin profile from the desktop to the typing surface to minimize wrist deviation. Keys should provide tactile and audible feedback.

Movable keyboards with flat or negative tilt-angle adjustments will allow operators to arrange keyboards to suit them. Matte-finished keyboard surfaces reduce reflections, easing operator eye strain. Keyboards fitted with wrist or palm rests support operators' hands by minimizing contact with table edges and minimizing wrist bending during pauses in keyboard activity. Wrist-pad thickness should not exceed the height of the first row of keys on the keyboard.

When using the keyboard, the operator's hands, wrist, and forearms should be in a reasonably straight line, parallel to and slightly above the keyboard. The shoulders should be relaxed, with the elbows next to the body.



Arm position

The mouse or control device should be at the height of the keyboard and to either side of it. The arm should be held close to the body for support, with the hand, wrist, and forearm in a reasonably straight line parallel to and slightly above the mouse. There is a wide selection of control devices. You may need to consult a professional ergonomist regarding their proper use and positioning.

Document holders

The document holder should be stable and adjustable for height, distance, and angle of view. The holder fully supports the document and can be used on either side of the monitor or between the monitor and keyboard, minimizing the need for the operator to move the head, neck, or back to look from the screen to the document.

Work surfaces

Selection of a stable worktable with an adjustable surface and a separate, adjustable keyboard shelf is recommended. If a mouse is used, the work area should accommodate the mouse and keyboard on the same level. Adjustable-height worktables and keyboards allow for a variety of operators and tasks.

A workstation that adjusts in height for sitting or standing work postures may be desirable for some workers and tasks.

If a fixed-height worktable is used, an adjustable-height keyboard tray should be available. The keyboard tray must be wide enough to accommodate both a keyboard and mouse or other positioning and control devices and the height adjustment mechanism must not interfere with the user's leg position.

All worktable surfaces should have a matte finish to minimize glare and reflection. The terminal table should also have sufficient leg room (depth and width), so there are no obstructions for knees, legs, shins, or thighs. The minimum depth for leg space is 15 inches at knee level and 23 and a half inches at toe level. The minimum width for knee space is 20 inches. The minimum width of the work surface should be 30 inches and minimum depth should be 24 inches to allow proper placement of the keyboard, monitor, and work materials.

Footrests

If an operator's feet do not rest flatly on the floor once the chair height has been properly adjusted, a footrest should be provided. Footrests should be stable, incline-adjustable, non-restrictive of leg movement, and removable. A footrest should be large enough to support the soles of both feet and should have no more than 30 degrees inclination. The top of the footrest should be covered with a nonskid material to reduce slippage.

Back problems

Problem: When a display screen is too low, it causes the operator to lean forward, slouch down, or lower his or her chair to improve screen viewing. This can cause the lower curve of the back to flatten as a result of no lumbar support.

Solution: Raise the monitor to the correct viewing height, so that the topmost active line of the character display on the screen is at or just below the operator's eye level.

Neck problems

Neck strain is also a common complaint, and causes are often related to the video display terminal (VDT) monitor height, the absence of a document holder, or improper positioning of the holder.

Problem: The monitor is too high or low, causing the user to bend the neck backward or forward to see the screen.

Solution: Lower or raise the monitor to the correct viewing height.

Problem: Documents placed flat and off to the side of the work surface cause forward bending and twisting of the neck.

Solution: An articulated document holder or a document holder mounted on the monitor, positioned at the same elevation as the monitor screen, should relieve this problem. A document holder should be usable on either side of the monitor between the keyboard and the VDT screen.

Problem: The document holder is too far off to the side, causing repetitive neck rotation.

Solution: The screen and document holder should be the same distance from the eye to avoid constant changes of focus and close enough together so that the operator can look from screen to document without excessive neck or back movement.

Shoulder problems

Shoulder strain can occur when the user's arms are positioned too high or too low. When VDT operators' hands and arms are too high, they tend to pull their shoulders up, straining their shoulder and back muscles. When their hands and arms are too low, they pull their shoulders down, putting pressure on shoulder and back muscles and compressing nerves in the neck and arms.

Problem: The arms are too high or too low when using the keyboard.

Solution: Adjust the keyboard or chair and reinforce the principle of keeping the operator's hands, arms, and forearms parallel to the keyboard.

Problem: The user's arms are too high or too low when using the chair armrests.

Solution: Remove the armrests or replace with adjustable armrests.

Forearm and hand problems

Problems can occur if the user's hands don't form a straight line with the forearms or if the sharp edge of the work surface presses against the palms, wrists, or forearms.

Problem: The keyboard is too thick, too low, or too high, causing wrist bending.

Solution: Purchase thin keyboards to minimize wrist deviation. Adjustable-height and sloped keyboard trays make proper keyboard height and hand-wrist posture easier to accomplish. A keyboard fitted with a wrist rest will support the heel of the operator's hand and minimize wrist deviation. The wrist rest thickness should not exceed the height of the first row of keys. Wrists should never rest on the wrist pad when using the keyboard. Wrist rests are to be used between periods of typing.

Problem: The keyboard user supports the wrists on the edge of the work surface while typing or resting. This can cause backward bending of the wrist, numbness of the hand and fingers, or tingling.

Solution: All table surface edges should be rounded, and the keyboard should be retrofitted with a wrist rest.

Leg problems

Leg problems can result from decreased blood circulation. This causes the legs to fall asleep.

Problem: The edge of the seat pan presses against the thighs.

Solutions: A proper seat-pan length allows for a two- to three-finger clearance from the front edge of the chair to the back of the thighs upon properly adjusting the chair height to the workstation. Use a footrest if feet aren't flat on the floor.

Problem: Excessive knee flexing from using the foot rungs on the chair or chair legs as footrests.

Solutions: Properly adjust chair and provide a footrest, as needed.

Vision problems

There are no conclusive studies to prove that permanent vision or eye problems are caused by VDT use; however, common complaints include eye strain, burning eyes, blurred vision, irritated eyes, and headaches.

Solutions: Because these complaints are associated with focusing at close range, the minimum eye distance should be 16 inches from the monitor.

Recommend a short rest break (3-5 minutes) following each hour of continuous VDT work, during which time the operator should get up and stretch, move about, or do other work. Periodically focus on distant objects. This relaxes eye muscles.

Uncorrected or improperly-corrected vision can aggravate any of these complaints. When getting fitted for glasses, VDT operators need to tell their eye care specialists that they perform VDT work regularly. The focal distance for reading (10-12 inches) is less than it is for VDT work (16-29 inches).

People wearing bifocals or trifocals have to tilt their heads back to read through the bottom portion of the lenses. This can cause neck strain. Correct the problem by lowering the VDT screen height or using single-focal-length glasses specifically for VDT use.

Poor or excessive lighting contributes to vision problems. The illumination level for VDT work should be 20-50 footcandles for screen viewing only and 50-70 footcandles for reading printed documents.

Room glare can be reduced or eliminated by lowering the lighting; having the operator sit facing a matte-finished, dark-colored wall; or adjusting the screen upward, downward, or slightly to the left or right. However, too much screen deviation can cause neck problems.

- Position the VDT workstation at right angles to the window.
- Install the VDT workstation between rows of overhead lighting.
- Install screen glare filters and visor hoods over the monitor screen. A screen glare filter should be your last resort, because it may reduce image quality.

Window glare can be reduced or eliminated by covering the windows with draperies or blinds.

- Install natural-density filter shades over the windows.
- Add outdoor window awnings.

Muscle fatigue problems

VDT work consists of fixed posture and repetitive motions, resulting in local muscle fatigue. Muscles need rest to prevent discomfort, fatigue, and possible injury or illness. To reduce muscle fatigue for VDT workers:

- Take frequent breaks of shorter duration (three to five minutes) every hour.
- Change job tasks to reduce fatigue and monotony, allowing different sets of muscles to be used.
- Exercise to help relax tight muscles, reduce stress, and lessen the sense of general fatigue.

How to select workstation computer equipment was excerpted from Oregon OSHA's *Health and Safety Guidelines for Video Display Terminals in the Workplace*.

Keyboard — foot pedals

Worker disability

A medical office clerk sustained bilateral carpal tunnel syndrome because of repetitive use of her hands doing data entry and other repetitive tasks.

Work setting

The worker was able to return to a modified version of her regular job. Her duties were altered to eliminate repetitive handling of heavy medical charts. Although her data-entry duties were reduced, they were not eliminated.

Modification

Foot pedals were installed at the worker's computer. The worker assigned frequently used keys and macros to the pedals. The setup was easy and required no programming skills.

Cost of modification

The keyboard foot pedals cost \$139.

Obstacle

The worker's physician directed her to minimize keyboarding and other repetitive upper extremity activities.



Keyboard — spring assist

Worker disability

A 34-year-old office manager had a soft-tissue thoracic injury, resulting in sitting limitations.

Work setting

The worker returned to her regular job as office manager for a small construction company. She is responsible for accounts receivable, billing, scheduling, and payroll. She uses a computer an average of six hours a day.

Obstacles

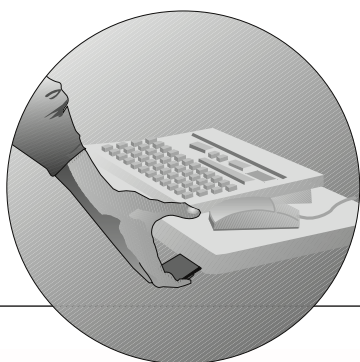
Because of the injury to her mid back, the worker's doctor restricted her to sitting no more than 30 minutes at a time.

Modifications

The employer's small office is in a trailer. Because of space, weight, and wiring limitations, an electrically adjustable desk was not feasible. As an alternative, a spring-assist adjustable workstation was provided. With a simple squeeze on a control pad, the work surface adjusts to accommodate sitting or standing. The worker was also provided an ergonomic chair that reduces static muscle loading while she sits. A cordless telephone headset permits her to move without interfering with her workstation.

Cost of modifications

The spring-assist adjustable workstation costs about \$1,800; ergonomic chair, \$550; and cordless headset, \$275.



Voice-activated computer

Worker disability

The 45-year-old county agency supervisor was diagnosed with bilateral carpal tunnel syndrome. After three surgeries, she had a permanent inability to do more than 30 minutes of typing a day.

Work setting

The worker supervised a number of people located throughout the county and performed a variety of office duties.

Cost of modification

The computer upgrade, software for voice activation, and training cost about \$3,500.

Obstacle

Although the worker could dictate documents and have them typed, she frequently found it necessary to use the keyboard. It was necessary for her to be in frequent e-mail contact with others. She also frequently needed to both enter and retrieve data, which resulted in the need to do keyboarding for several hours a day.

Note

For voice activation, it is important that the computer have adequate speed and RAM. The computer must have a CD-ROM with speakers and the recommended sound card. Check with the manufacturer or a specialist in voice activation. The “professional” versions of software and adequate training are recommended.

Modification

Computer software allowed the worker to perform her computer work by voice command. Because her computer would not support the software, an upgrade was necessary. A consultant installed and trained her to use the new system.



Gravity-fed conveyor table

Worker disability

A 40-year-old production worker injured her back, which resulted in a lifting restriction of 20 pounds and an inability to stand for prolonged periods.

Work setting

The job requires lifting cartons weighing up to 50 pounds from a pallet and carrying them to a workbench. The job also requires standing for up to two hours while sorting and boxing envelopes.

Obstacles

Obstacles included lifting and carrying cartons weighing 50 pounds from a pallet to a workbench and standing still for long periods.

Modifications

An ergonomic chair with a lumbar support allowed alternate sitting and standing. A portable gravity-fed conveyor apparatus was set up so that at the beginning of the shift, another worker could stack the cartons on the conveyor. This allowed the worker to push the carton to the workbench to eliminate lifting and carrying.

Cost of modifications

The gravity-fed conveyer table cost about \$1,600.



Roller conveyor system — bottling line

Worker disability

A 56-year-old canister washer injured her back which resulted in limited pushing and pulling capacity and inability to repetitively twist and bend.

Work setting

A canister washer constantly bends, twists, and lifts used canisters into the wash and removes clean canisters to a pallet.

Obstacles

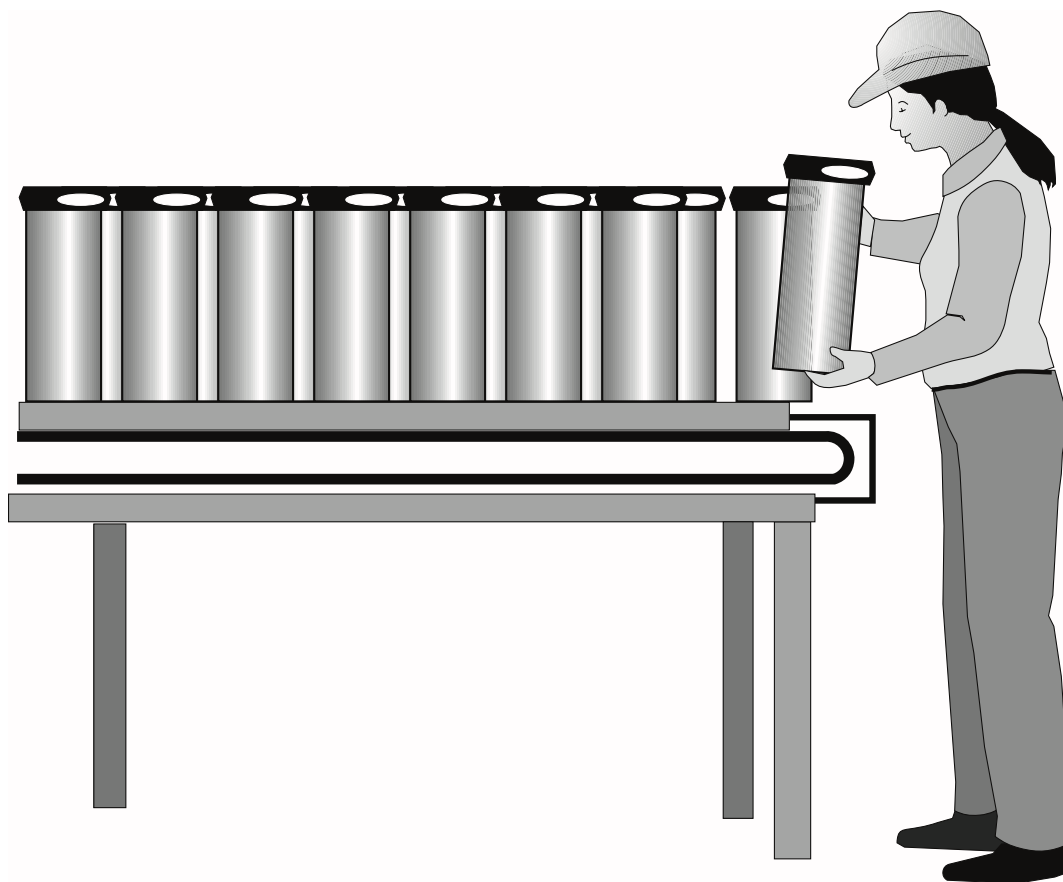
Inability to push or pull pallet to the washer on a roller conveyor; load canisters from pallet at floor level into washer at chest height; and remove clean canisters.

Modifications

The roller conveyor system leading up to the washer was converted to an electric conveyor and raised 27 inches. The power conveyor eliminated the need for the worker to push or pull pallets to the washer. Raising the system placed the pallet at waist height so that the worker did not have to bend to retrieve the canisters.

Cost of modifications

The conveyor system cost about \$4,000.



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***Oregon* Department of Consumer & Business Services**

Contact information

Workers' Compensation Division

Preferred Worker Program (PWP) (Toll Free)	800-445-3948
Salem.....	503-947-7588
Medford.....	541-776-6032
PWP Web site	www.oregonpwp.info
E-mail address.....	pwp.oregon@state.or.us
Benefit Consultation Unit (Toll Free)	800-452-0288
(Benefits or concerns).....	503-947-7585
E-mail	workcomp.questions@state.or.us
Vocational assistance	503-947-7816
Ombudsman for Injured Workers	503-378-3351
Toll free in Oregon.....	800-927-1271
Web site.....	egov.oregon.gov/DCBS/OIW
Ombudsman for Small Business	503-378-4209
Web site.....	egov.oregon.gov/DCBS/SBO
Oregon Occupational Safety and Health Division (OR-OSHA) (Toll Free)	800-922-2689
Web site.....	www.orosha.org



Workers' Compensation Division

Reemployment Assistance Unit

350 Winter St. NE

PO Box 14480

Salem, OR 97309-0405