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'INFOLIO'

NR. A19-AU2 (= 020-AU2)

TITLE:

AUTOMOBILES

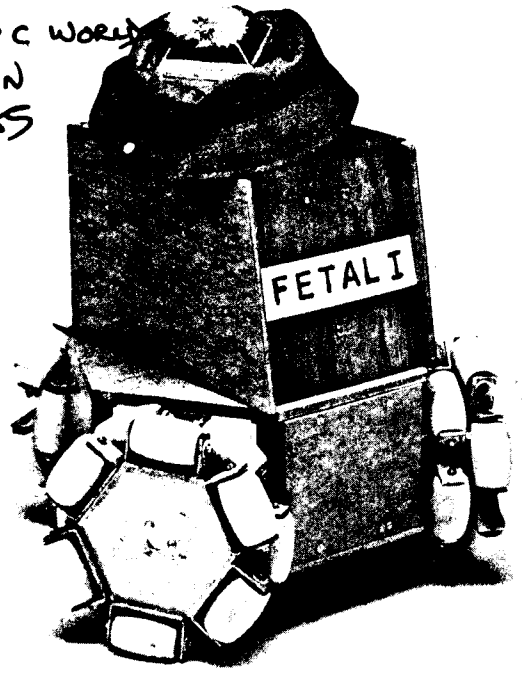
2

(WHEELS)

020-AU2 AUTOMOBILES # 2 (WHEELS) --- 7 Articles about bizarre wheel designs: Self-turning Wheel..Ilion's Omni-directional wheel..S. Jones' Elastic Spring Wheel.. More!

Last month this same photo slot featured this unique wheeled vehicle invented by Dean Harper of Dunbar, West Virginia. Just to show that Dean isn't standing still, this month his unique thingamagig is shown with a motor – and the inventor at the helm ... steering wheel? Imagine that!

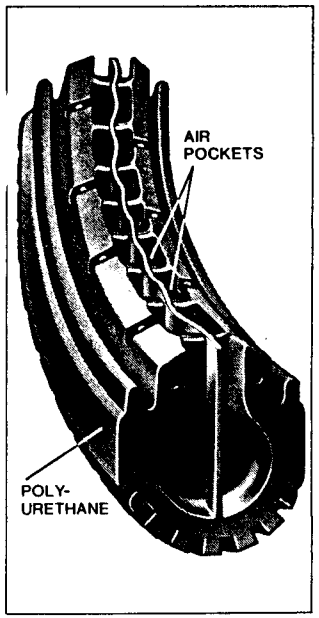
PC WORLD
JAN '85



Metamotion's Fetal 1 robot demonstrates Bill La's omnidirectional wheel system. The three wheels are independently driven and enable the robot to move in all directions and pivot on a vertical axis. The Metamotion system is being adapted for electronic wheelchairs and robot plotters.

Puncture-proof tire

No more punctures—ever. That's a British firm's promise for its molded-plastic bicycle tire. The semi-pneumatic tire has a molded-in honeycomb pattern of air pockets. It looks and rides like a conventional bicycle tire. Sure-Trak Ltd., Lancashire, England. Price: $130.



BREAKTHROUGH CAPSULES Turbo power booster -- Engines equipped with newly developed turbocharging system produce up to 25% more horsepower than engines with conventional turbos -- and use about 15% less fuel. Secret: Even pressurization of the fuel/air mixture fed to the cylinders (conventional turbos produce varying, inefficient levels). Applications: Cars, trucks, any machinery run by internal combustion engines. Details: Turbotech,* 7251 Balboa Blvd., Van Nuys, CA 91406...

New Hoop Cycle Hits Lively Clip

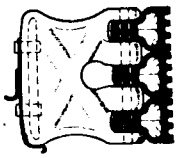
A LARGE rubber-tired hoop is both the body and the traction wheel for an unusual vehicle recently completed by Julius Rose, a Glendale, N. Y., auto mechanic. Fitted with a diminutive front wheel steered by means of handlebars, as shown at the right, the curious cycle is powered by a gasoline engine placed between the operator's legs. The machine is said to travel up to fifty miles an hour and to run 250 miles on one gallon of gas.

Julius Rose testing his novel cycle. It makes 250 miles on only a gallon of gasoline

Rubber Spokes Give Bounce to Airless Safety Tires

POP. SCI. 1938

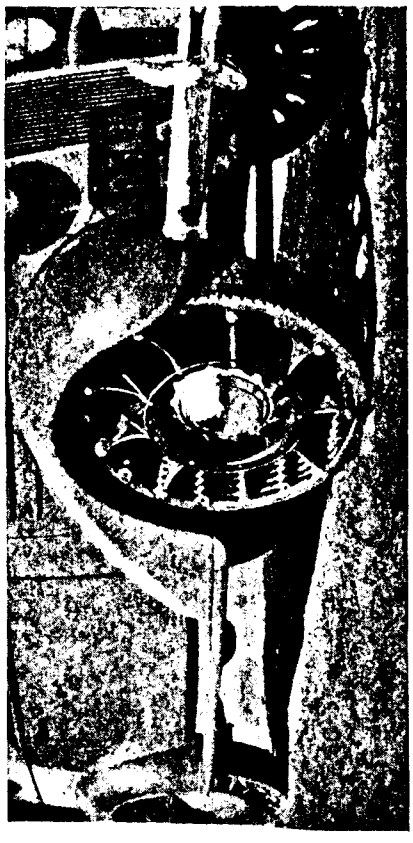
HARD WOOD, embedded in rubber, forms the rim of a new safety tire invented by J. V. Martin of Garden City, N. Y. Said to be more resilient and lighter than pneumatic types, the safety tire has hoops of hickory incased in rubber and fitted with criss-cross spokes of ribbed rubber. Punctureproof and blowout-proof, the airless tires absorbed practically all vertical movement when a springless test car drove over four-inch blocks strung along a concrete road in a recent trial, it is claimed.



Engine Runs on Acetylene with New Carburetor

Engine equipped to burn acetylene, with gas generator in the background. The special carburetor is seen in the smaller photograph

RUNNING an internal-combustion motor on acetylene, a gas generated from calcium carbide and water, instead of on gasoline, is made possible by a special carburetor perfected after seventeen months of experimental work by Herman Pederson, of Brooklyn, N. Y. The device employs a pair of small propellers to provide a constant gas pressure, and special graduated supply lines to increase the pressure of the gas before it enters the engine cylinders. In a laboratory test, Pederson states, a motor equipped with this carburetor ran for two hours and thirty-five minutes on acetylene produced from fuel that cost only twenty-three cents, compared with a run slightly more than half as long when the motor operated on a gallon of gasoline that cost eighteen cents. Pederson believes that his carburetor will ultimately make acetylene replace gasoline as a motor fuel.



TECHNOLOGY / JOHN ECKHOUSE

Self-Installing Snow Chains for Tires

Most people don't think about snow in August, but truck drivers who plan ahead will never again have to install chains on their tires in a freezing snowstorm. Onspot Inc. of Provo, Utah, is distributing a new automatic, dashboard-activated snow chain that works on trucks and buses.

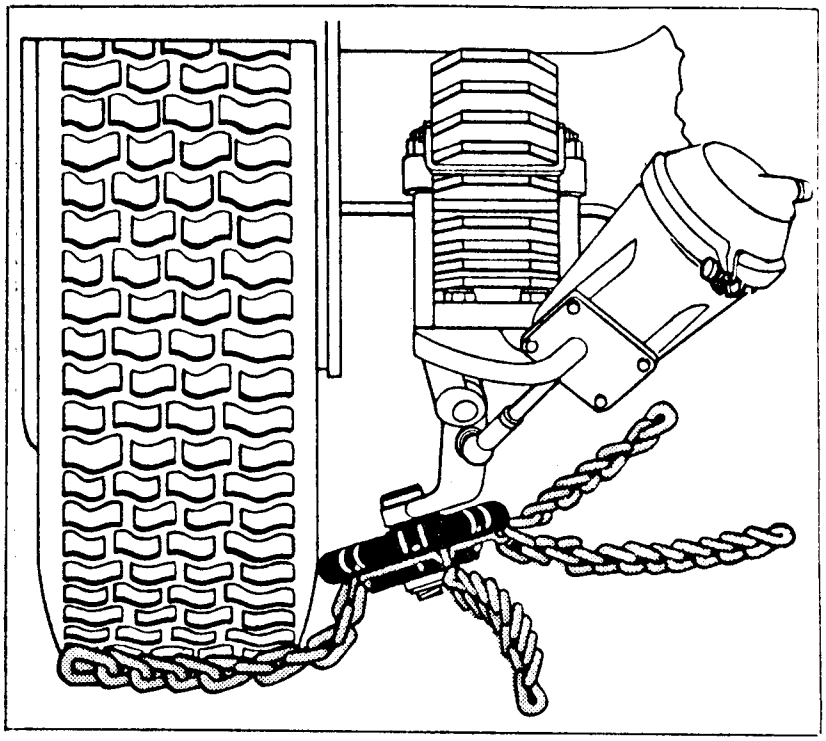
Lou Nackos, marketing director for Onspot, said a driver can activate the Swedish-developed chains in less than two seconds — even while traveling at up to 25 miles per hour — without getting out of the truck. He said it normally takes about 45 minutes to put on conventional truck tire chains in cold weather.

The Onspot device consists of a hard rubber disk with six chains, each about 13 inches long, spaced equally around its circumference. The disk is mounted on a hinged shaft attached to the truck axle.

When the driver pushes a button, an air cylinder pushes the disk down onto the inside of the tire on about a 40-degree angle. As the tire rotates, the disk turns and throws each of the lengths of chain under the tire. When you no longer need the chains, push a button and they rotate back away from the tire.

Nackos said his product is just as strong and effective as conventional chains except in deep snow. "But they are safer than regular chains because they will be used, while about half the time drivers fail to attach their chains when needed because they don't want to bother," he insisted.

Nackos said the chains, which cost $995 and take about three hours to install, have been approved for use by the California Highway Patrol. The concept won't work on automobiles yet because there is not enough clearance underneath the vehicle.



Artist's version of the Onspot snow chain device in action

Self-Damping Sprung Wheel

The rim deflects in the vicinity of the contact with the ground or floor.

Marshall Space Flight Center, Alabama

The self-damping sprung wheel provides a shock-absorbing suspension for a wheelchair, reducing the user's discomfort when traversing rough terrain or obstacles. A pair of self-damping sprung wheels are installed in place of the conventional large rear wheels of a standard wheelchair, which the user then operates in the conventional manner.

Other types of shock-absorbing suspensions are not suitable for wheelchairs. For example, when a rigid wheel on a spring suspension encounters an obstacle, the entire wheel is pushed upward, and the top of the wheel can make contact with the user's arm. In addition, the handwheel portion vibrates along with the rest of the wheel; this makes it difficult for the user to grasp and apply force to the handwheel. In contrast, the self-damping sprung wheel does not rise and fall in its entirety; the only part that deflects is a portion of the rim in the vicinity of the contact with the floor, ground, and/or obstacle.

The wheel includes a central hub that turns on conventional bearings, with radial spokes extending from the hub to a flexible rim (see Figure 1). The handwheel is attached to the spokes near their outer ends. A slot in the outer end of each spoke accommodates the radial sliding of a cylindrical knob attached to a rim connector tang. In the normal undeflected condition, the rim spring-loads every cylindrical knob radially outward against a cover plate, which retains the knob in the slot. When a portion of the rim is deflected radially inward by contact with an obstacle, the knob(s) in the affected spoke(s) slide radially inward along the slot(s).

As shown in Figure 2, the rim includes thin inner and outer hoops of molded reinforced plastic, plus an elastomeric intermediate hoop bonded to the inner and outer hoops. Tire-retaining tabs are attached to the outer hoop, and a standard airless polyurethane-foam wheelchair tire is mounted on the tabs. Where part of the tire and rim are deflected inward, the outer hoop is loaded in compression, the inner hoop is loaded in tension, and the elastomeric intermediate hoop is loaded in shear. The shear deformation of the elastomer absorbs the energy stored in the bending of the rim, thereby providing damping.

An alternative version of the wheel could be designed for a bicycle. The tire-retaining tabs and wheelchair tire would be replaced by a continuous-strip retainer and pneumatic tire, the handwheel and its mounting fixtures would be deleted, the stiffness of the rim would be changed to accommodate greater speeds, and the hub would be modified to accommodate bicycle-style bearings and fork mounting.

This work was done by Bruce Weddendorf of **Marshall Space Flight Center**. *For further information, Circle 27 on the TSP Request Card.*

Inquiries concerning rights for the commercial use of this invention should be addressed to the Patent Counsel, Marshall Space Flight Center [see page 20]. Refer to MFS-28632.

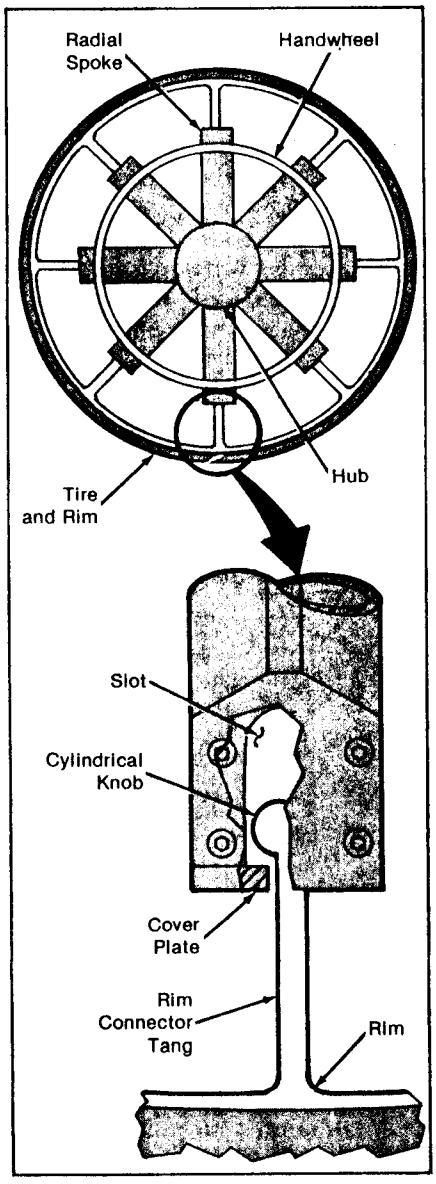


Figure 1. The **Knob Slides In the Slot** to accommodate deflection of the rim.

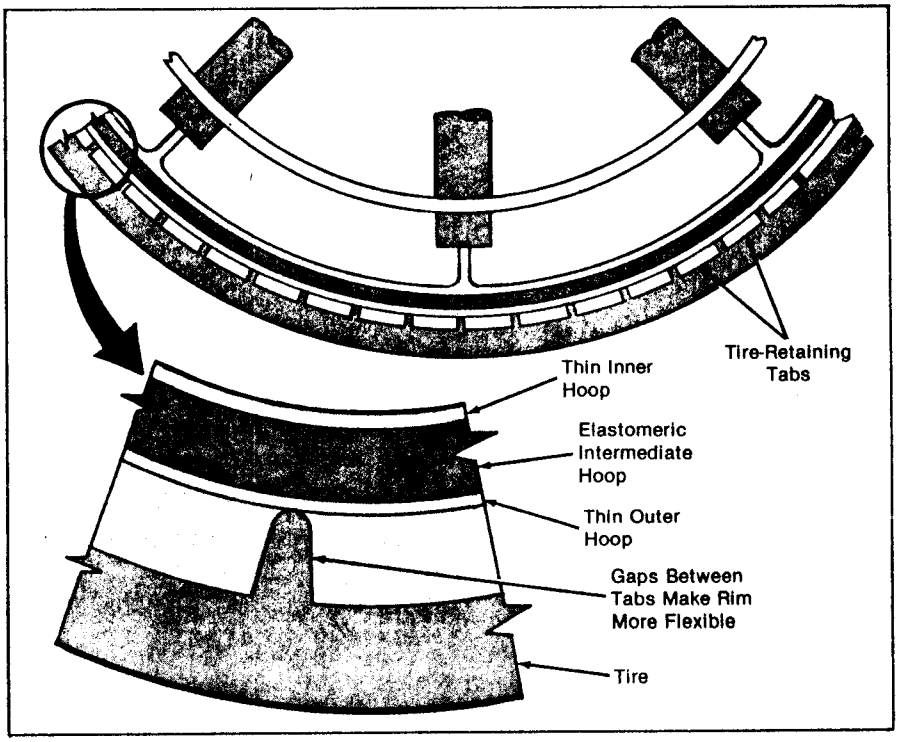
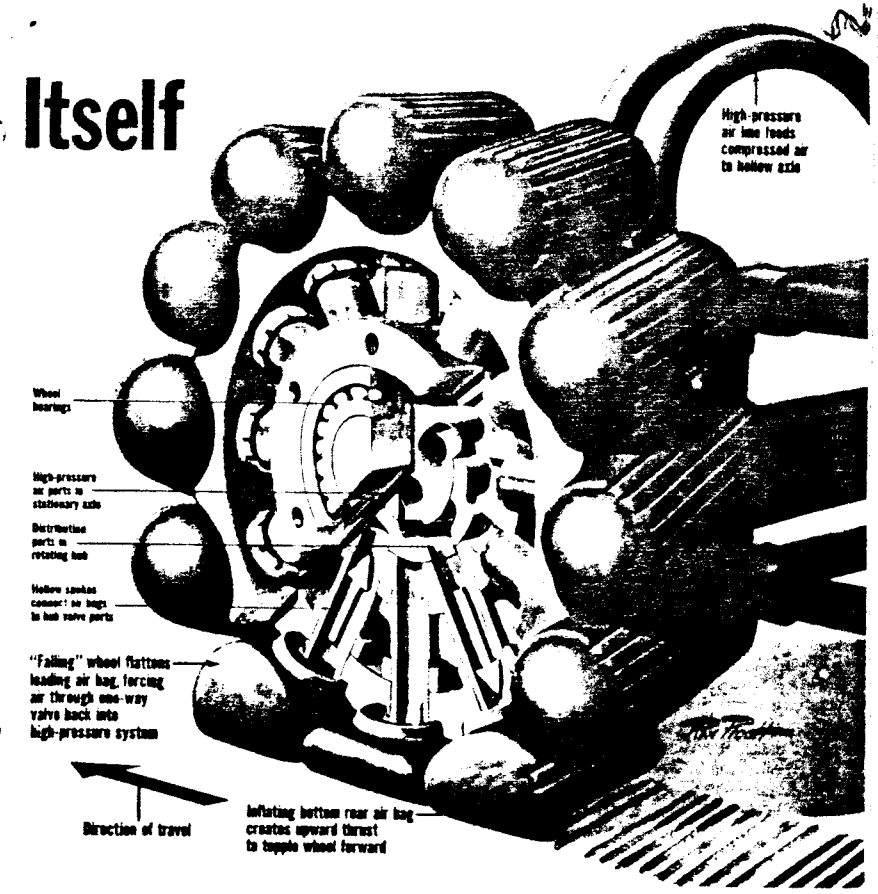


Figure 2. The **Rim Includes Inner and Outer Hoops** that bend when an obstacle is encountered. The shear deformation of the elastomeric hoop between them absorbs energy. Thus, the three hoops act together as a damping spring.

This Walking Wheel Turns Itself

Sausage-shaped air bags, differentially inflated by a compressed-air tank, propel 18-inch-long model of a walking-wheel vehicle. Deep and broad tread pattern on ground testifies to excellent traction on rough terrain. Tests show that optimum hill climbing and acceleration are obtained when overall wheel diameter, relative to rim diameter, is as large as possible.



By David Scott
EUROPEAN EDITOR

A REVOLUTIONARY form of locomotion—a wheel that drives itself the way a man walks—has been developed in Czechoslovakia. Its self-propulsion eliminates the usual car transmission, prop shaft and differential with their hefty losses, waste of space, and undesirable weight. Rolling resistance is greatly reduced, the wheel won't spin under power either on ice or mud or when it bounces off the road into the air, and there is no torque reaction to the axle and chassis.

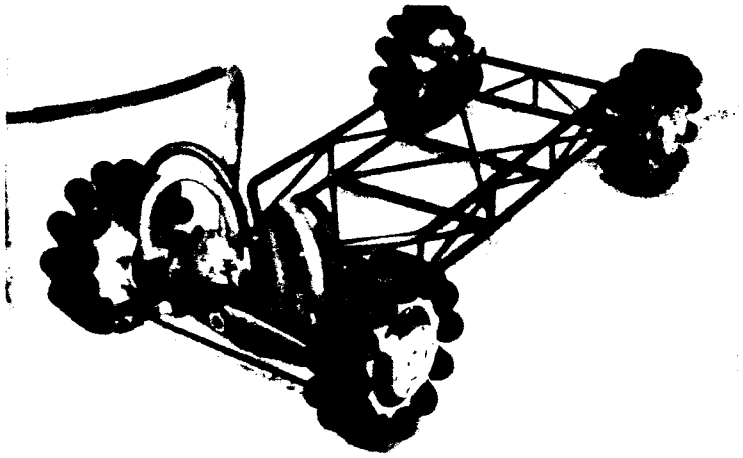
Basically, the wheel relies for traction on gravity rather than friction. Researchers of the Motor Vehicle Research Institute in Prague who developed the self turning wheel took the way humans walk as a model. The supporting foot rests on the ground behind the center of gravity, and the body falls forward until checked by the other foot.

Adapted to a wheel, the principle concentrates driving power in the spot of contact between tire and ground. Cutting out all the gears in the drive train saves the engine power that they waste—as much as 20 percent.

Instead of a conventional tire, the Czech wheel is shod with a ring of individual air bags. Inflating the bags to different pressures makes it rotate. Full pressure is applied to the underside bag behind the axis, throwing the wheel off-balance and causing it to topple—or roll—forward.

The bag directly beneath the hub is meanwhile partly inflated to cushion the ride. As the wheel rotates, the sequence repeats to provide continuous movement, and pressure is reduced in each compartment as it leaves the ground.

Differential inflation is automatic. Compressed air is piped through the stationary axle shaft to distribution ports in the hub connecting with the individual bags.



Four-wheel-drive test model, shown without its compressed-air tank, may be the forerunner of a new breed of cross-country vehicles. Besides excellent traction, walking-wheel design offers low ground pressure thanks to light weight and the large surface area resting on the ground.

The turning of the wheel opens and closes the rotary valves.

To prove the theory, the research engineers built an 18-inch-long four-wheel-drive model. Tires consist of 12 cylindrical compartments resembling sausages. These are pitched at an angle around the rim like the teeth of a helical gear, so that ground contact between adjacent bags overlaps slightly to avoid a jogging movement.

Power is from a compressed-air bottle, and the tubular frame of the model serves as ducting. Air is piped to and from the wheels in a closed circuit, and pressure released from the deflated bags is returned to the system through one-way valves to minimize losses and power requirements.

Fast movers ahead. The Czechs believe cross-country vehicles will be the first likely application of the new design because it combines exceptional traction with low ground pressure—the result of light weight and wide tires. The power source might be an air compressor driven by a small piston engine or a gas turbine.

The drive needn't be limited to slow movers, however. Cheap-to-run cars, with solar energy providing hot air for propulsion, are envisaged.

Speed would be controlled by regulating the air pressure. Radially moving inlet-distribution valves on the axles could be shifted to vary the effective torque like a conventional gearbox. Reverse would be obtained by altering valve timing to inflate tire compartments in front of the wheel hubs.

Gradual shift from forward to reverse drive might be used for engine braking.

For coasting, you'd just cut the power, and the bags would continue to inflate and deflate themselves through the closed-circuit piping. Alternatively, all bags might be blown up to equal pressure when braking normally.

Though the self-driven wheel is in its infancy, it suggests several practical advantages. Four-wheel steering as well as drive would be simple, as there is no mechanical transmission to limit wheel angles. Crablike movement for overtaking or parking might be possible. A puncture would be confined to one compartment, which could be replaced without jacking up the car or removing the wheel. You'd need no bulky spare. ■■

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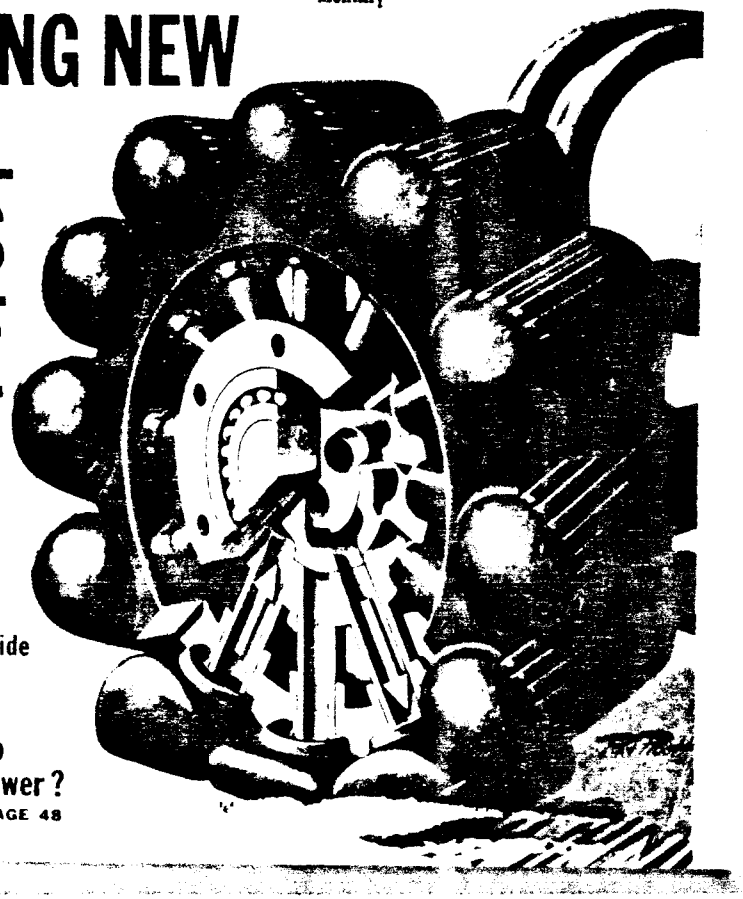
Popular Science

Monthly

'65 Cars: Big Changes Ahead?
PAGE 40

"Say, Smokey—" America's Most Famous Mechanic Helps You Get More Out of Your Car

AMAZING NEW WHEEL TURNS ITSELF
PAGE 44



Dangerous Dams—Disasters Waiting to Happen
A Startling Nationwide Report by PS

What Happens to All That Horsepower?
PAGE 48

301

United States Patent [19]

Ilon

[11] **3,876,255**

[45] **Apr. 8, 1975**

[54] **WHEELS FOR A COURSE STABLE SELFPROPELLING VEHICLE MOVABLE IN ANY DESIRED DIRECTION ON THE GROUND OR SOME OTHER BASE**

[76] Inventor: **Bengt Erland Ilon**, Stromkarlsvagen 43, 161 38 Bromma, Sweden

[22] Filed: **Nov. 13, 1972**

[21] Appl. No.: **305,887**

[52] **U.S. Cl.** ..... **301/5 P; 301/5 R**

[51] **Int. Cl.** **B60b 19/00**

[58] **Field of Search** ..... 301/5 P, 5 R; 280/DIG. 7; 305/50

[56] **References Cited**

UNITED STATES PATENTS

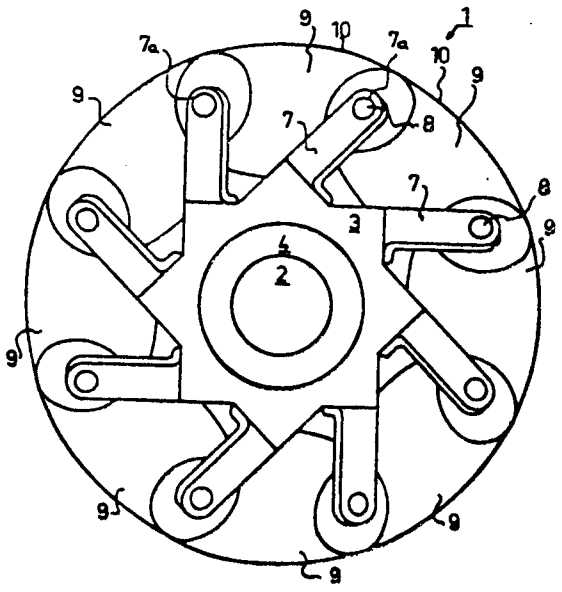
3,789,947 2/1974 Blumrich ..... 301/5 P

Primary Examiner—M. Henson Wood, Jr.
Assistant Examiner—Reinhard J. Eisenzopf
Attorney, Agent, or Firm—John J. Dennemeyer

[57] **ABSTRACT**

A wheel for a course stable selfpropelling vehicle, having a centre part rotatable about an axis and a plurality of ground engaging means rotatably mounted on the centre part about the periphery thereof. Each ground engaging means being an elongated roll having its surface convexly vaulted in longitudinal direction and being mounted with its axis extending obliquely with respect to the axis of rotation of the centre part. The spacing between the rolls and the angle between the longitudinal axes of the rolls and the axis of rotation being selected so that the rolls define together an unbroken wheel periphery, seen from a point on an extension of the axis of rotation.

15 Claims, 6 Drawing Figures



United States Patent [19]

Blumrich

[11] **3,789,947**

[45] **Feb. 5, 1974**

[54] **OMNIDIRECTIONAL WHEEL**

[75] Inventor: **Josef F. Blumrich**, Huntsville, Ala.

[73] Assignee: **The United States of America as represented by the Administrator of the National Aeronautics and Space Administration**, Washington, D.C.

[22] Filed: **Apr. 17, 1972**

[21] Appl. No.: **244,519**

[52] **U.S. Cl.** ..... **180/79.3**, 301/5 P

[51] **Int. Cl.** **B62d 5/02**

[58] **Field of Search** ..... 180/79.3, 6.2, 7 R, 8 F; 301/5 P

[56] **References Cited**

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3,465,843 9/1969 Guinot 180/79.3

FOREIGN PATENTS OR APPLICATIONS

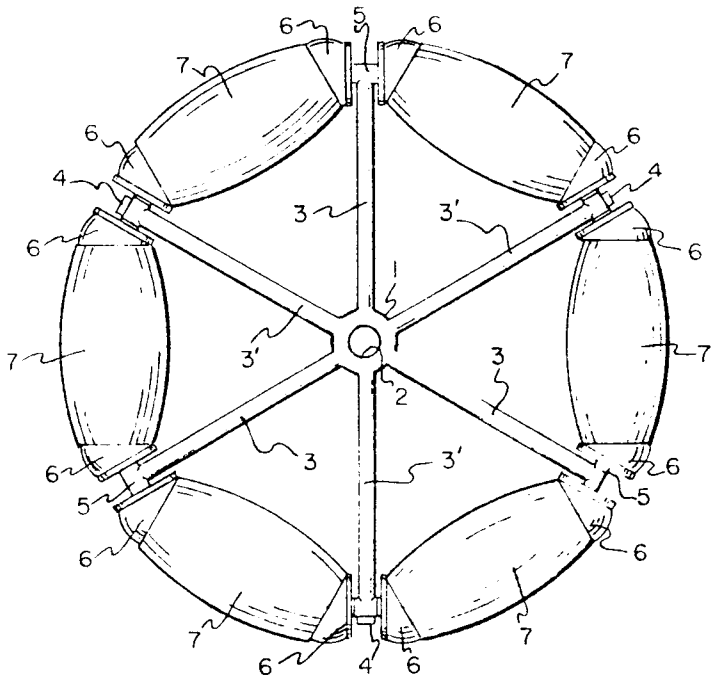
822,660 11/1951 Germany ..... 301/5 P

Primary Examiner—Kenneth H. Betts
Assistant Examiner—John A. Pekar
Attorney, Agent, or Firm—L. D. Wofford, Jr. et al.

[57] **ABSTRACT**

The apparatus of the invention consists of a wheel having a hub with radially disposed spokes which are provided with a plurality of circumferential rim segments. These rim segments carry, between the spokes, rim elements which are rigid relative to their outer support surfaces, and defined in their outer contour to form a part of the circle forming the wheel diameter. The rim segments have provided for each of the rim elements an independent drive means selectively operable when the element is in ground contact to rotatably drive the rim element in a direction of movement perpendicularly lateral to the normal plane of rotation and movement of the wheel. This affords the wheel omnidirectional movement.

5 Claims, 4 Drawing Figures



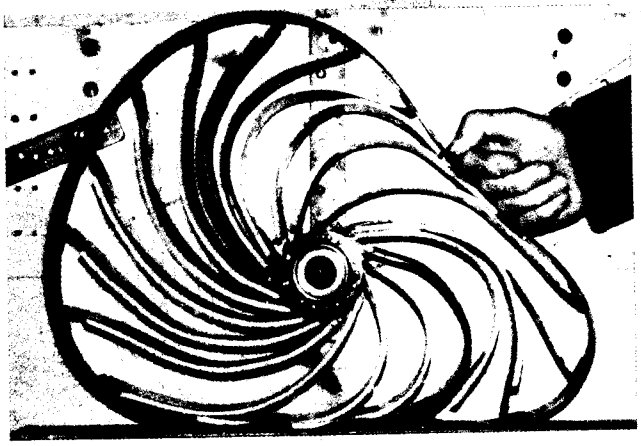
OMNI '82

REINVENTED WHEEL

People have tried for centuries to improve the wheel, yet today's model looks very much like the one primitive man conceived. At last, however, a retired railroad researcher from Great Malvern, England, has succeeded in reinventing the wheel, and he says that his new version could revolutionize the world of transport.

The new wheel is better, according to inventor Sydney Jones, because its rim folds around obstacles in its path, conforming to their shape and rolling over them as if on a cushion of air. He explains: The spokes of the wheel and its rim, or tire, are made of elastic spring steel. Whenever the wheel hits a sharp curb or step, the elasticized spokes above the road bend like a knee, and the tire conforms to the shape of the ground. Thus molded, the tire can roll over the angular surface as easily as a rigid tire rolls over smooth terrain.

A vehicle fitted with such wheels, Jones says, could easily mount curbs and steps, making it ideal for wheelchairs and stretchers. Because of its ability to negotiate rough or muddy land, the wheel might also be appropriate for tractors or lunar exploration vehicles. Jones has even installed the new wheel on a motorized wheelbarrow that he hopes will take some of the back-breaking effort out of his gardening. — Ivor Smullen



The newest wheel: Spokes of elastic spring steel allow its rim to fold around obstacles, rolling over them as if on a cushion of air.

Springing Along on A Steel Wheel

A new wheel that looks like an inventor's nightmare has been conceived in England. And far from being a flop, says the deviser, his creation has the power to revolutionize transportation.

Both the spokes and rim of the wheel are made of elastic spring steel, according to *Omni*. When the device comes to an obstacle, like a sharp curb or step, the spokes bend like knees, and the tire conforms to the shape of the ground.

A vehicle fitted with such wheels, says the inventor, Sydney Jones of Malvern, England, could easily mount curbs and steps, making it ideal for wheelchairs. Because of its effectiveness on rough or muddy land, the wheel would also work on such vehicles as tractors and lunar exploration modules. □□

SEE ALSO: REX RESEARCH INFOLIO 'MOTION RECTIFIERS'

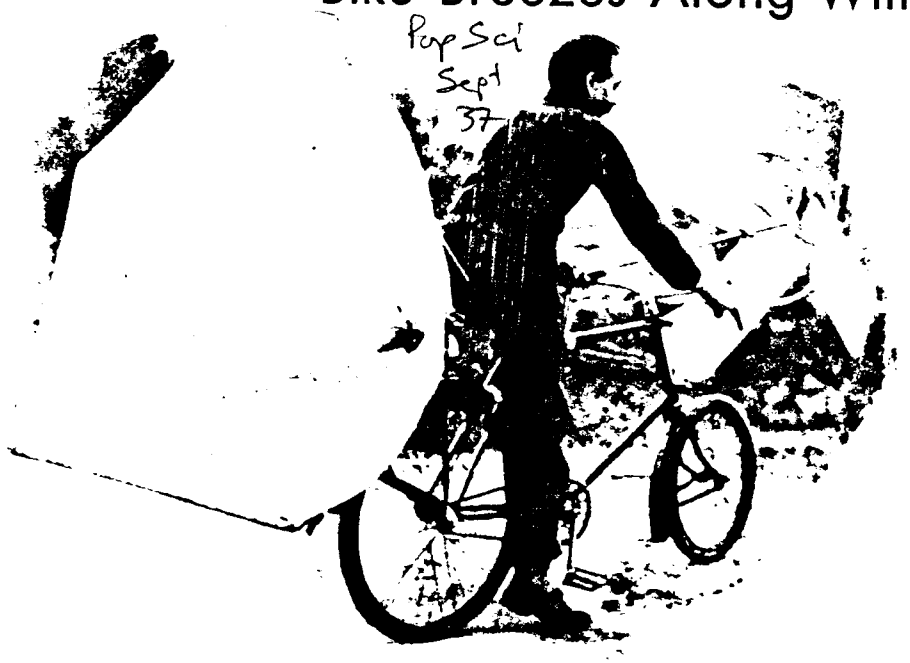
prototype transmission system could shift transportation means

A metal prototype of a transmission that could change the drive systems of everything from drill presses to earth movers has been built and refined for use on a standard bicycle frame. The system was built under the sponsorship of the Utah Innovation Center, Salt Lake City, by funds from the National Science Foundation. The inventor, Robert Williams, said his belt-driven transmissions can replace the chain, derailer, and gears on today's 10-speed bicycles, leaving a lighter, quieter, less-expensive vehicle that adjusts speeds automatically. The system uses two pulleys and regulates the speed by changing the ratio between them. The shifts occur vertically within the pulleys themselves as the ring of engagers on which the belt rides expands or contracts. Potential applications include motor driven vehicles, industrial conveyer systems, and machine tools.

No-wheel-drive vehicle

You've heard of two- and four-wheel drive, but no-wheel drive? It's completely practical, claims Dr. Arthur W. Farrall of Michigan State University, who recently demonstrated a working model. Called an "inertia propulsion vehicle," his device uses movable weights and operates on two cycles. An engine turns a cam during the cocking stroke, pushing a weight slowly forward and tightening a spring to which it is attached. During the power stroke, the cam releases the weight, and the spring snaps it back, providing the force to move the vehicle forward. Possibilities include cars that would never slip, tanks that could conquer the toughest terrain, and a tow truck that could move almost anything.

Bike Breezes Along With Sail and Propeller

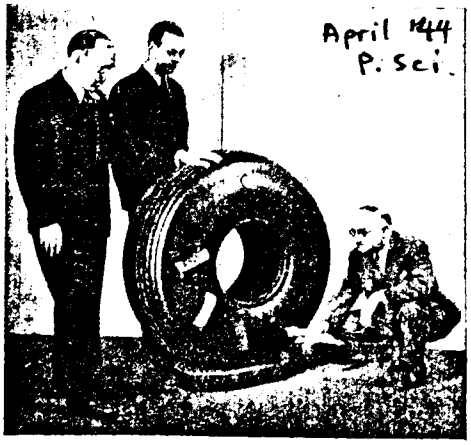


PREVAILING winds are harnessed by a French cyclist who has fitted his bicycle with a sail. Mounted behind the saddle, the canvas opens out like a clamshell to take advantage of a following breeze. For traveling against the wind, an odd four-bladed propeller, extending in front of the handlebars and geared to the sprocket wheel, supplements the conventional chain drive.

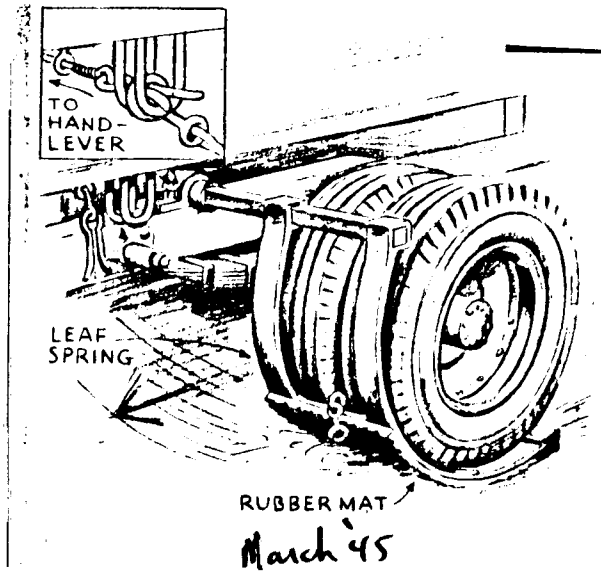
Oar Land Boat Rowed by Oarlike Levers

PROPELLED by two oarlike hand levers, and guided by a steering wheel at the rear that controls a single front wheel, an odd land rowboat is said to move at a speed considerably faster than a walk. The two levers are geared to two rear wheels. A single pull on both levers is said to propel the car the distance of several strides.

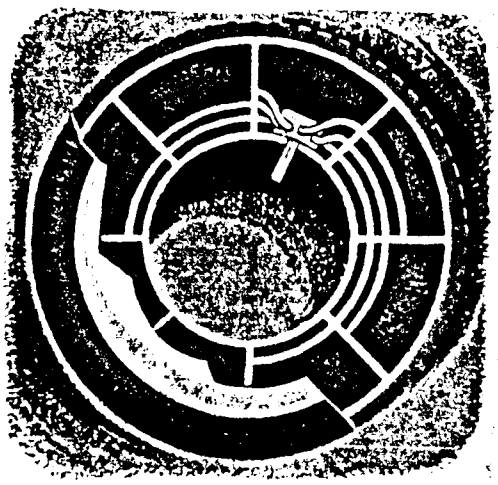
"Rowing" the land boat with levers



"PINWHEEL" TIRES that spin in the slip stream as a plane comes in for a landing mean longer tire life and smoother landings. Rubber-and-fabric fins attached to the side walls open to catch the wind and start the wheel turning, then close in the upper part of the revolution. By getting the wheels up nearly to the landing speed of the plane, this plan eliminates the burning and scuffing that result when tires are jerked from a standstill to high speed in a few seconds. The B. F. Goodrich Company developed the self-starting tires, one of which is seen in the photograph above.



NEW BRAKE CLUTCHES ROAD when lowered in front of rear wheels, which roll upon it to a standstill and drag the apronlike pad on the pavement. Designed as an emergency brake, this invention by Arch Robert Jackson, Shavertown, Pa., supplements the regular brake equipment standard on motor cars. It consists of arc-shaped leaf springs to which is secured a rubber mat, the bottom surface of which is corrugated to provide friction on the pavement. For use on icy road surfaces in winter, calks are provided, extending through the rubber. A special hand lever beside the driver controls the raising and lowering of the brakes through cables extending to transverse bars that hold the mats ready in position.



Tire Sections Save Flats. To prevent accidents caused by sudden tire punctures or blowouts, Morris and Leo Frankel, of Los Angeles, Calif., have patented a tire that is divided into eight separate segments, each of which must be individually punctured to cause complete deflation. When one segment is punctured, the adjoining ones expand to fill in the space, permitting the tire to continue in normal operation.

The Frisbee tire

Hans-Erik Hansson has taken a serious stab at reinventing the wheel. His design, a non-pneumatic composite wheel developed in Sweden, is claimed to have low rolling resistance, little external noise, and taut steering response. And although the car may appear to have four flats, the integral tire is puncture-free, so there's no need to carry a spare. "Outwardly it looks like a super-extreme low-profile tire," says Hansson.

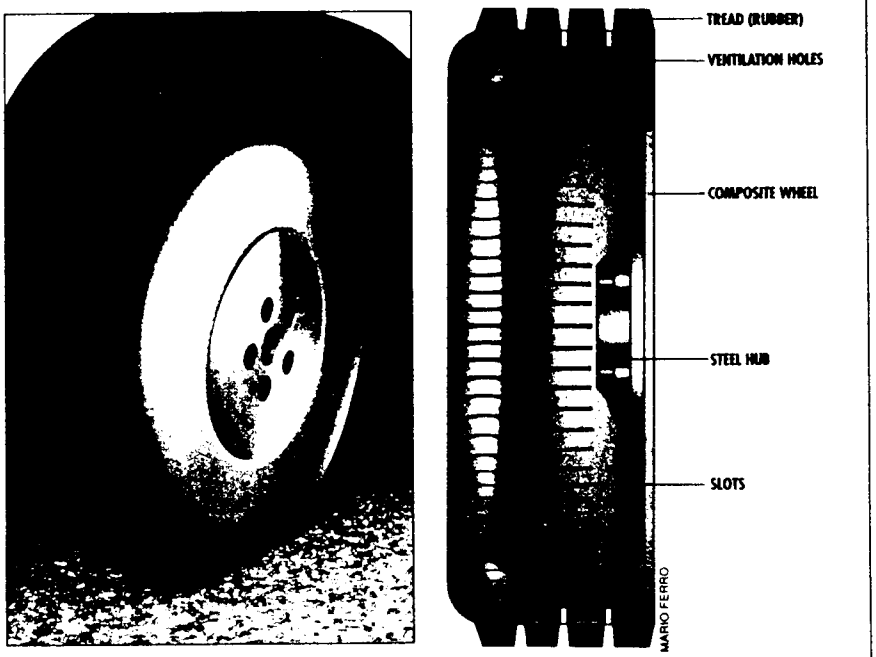
Shown in the sectional drawing (below right), the wheel is a bowl-like reinforced plastic molding with a steel hub. It has a flat central disc with the folded circular edge flared slightly outward to form the inner part of the rim. The edge then loops back on itself to form the outer rim, which is bonded to the rubber tread.

Both folded sections of the rim are slotted with 150 parallel cuts around the wheel circumference. These contribute to the tire's flexibility in the area where it makes contact with the road. The slots also provide water drainage to counter hydroplaning, as do small holes in the outer rim between the lines of the tread blocks.

"Our design concentrates tire deformation from wheel-loading and road irregularities very near the road surface, in contrast to the thick air cushion of conventional tires," Hansson explains. "This benefits steering and cornering characteristics. In addition, the tire has a square footprint that has about a 50 percent larger grip area than the usual oval one.

"In lab tests we've measured rolling resistance at up to 30 percent lower than a pneumatic tire," he says. "That's because our composite material has much less internal damping than rubber, which absorbs considerable energy as it's repeatedly compressed and released."

Unfortunately, the low damping of the composite wheel causes tire vibration to reach the car body, creating high internal noise. To counter this, a modified suspension is now being fit-



An all-composite tire is impossible to puncture, but still doesn't match the ride of conventional pneumatics.

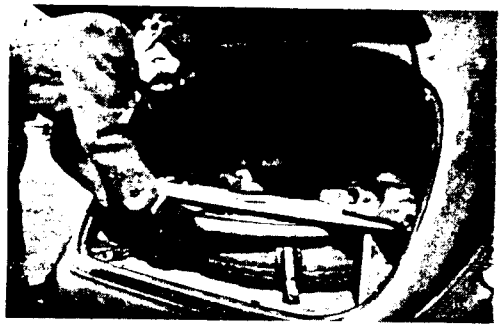
EMERGENCY WHEEL SAVES FLAT TIRES

P.Sci. Aug. '42

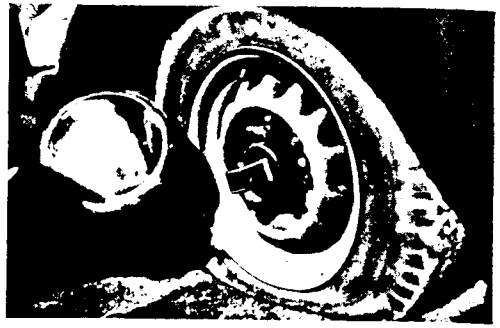
AN EMERGENCY wheel that gets you to a service station despite a flat tire has been devised by Nicholas Z. Grasso, of Hollis, N. Y. It permits driving without injuring a flat tire, is usable on front or rear wheels, and does not interfere with brake action or power.

The wheel is a sturdy metal disk with a solid rubber tire. At its center is a segment with a square hole, which slides on tracks through a limited distance. On getting a flat tire, the motorist removes the emergency wheel from storage beside his spare, removes the hub cap from the wheel with the flat, and fits the square hole of the disk wheel over a permanent, square-ended hub held on the regular wheel by the wheel studs. A special pin holds the wheel on the hub. As the car starts, the first half turn of the eccentric emergency wheel raises the flat tire, then centers the emergency wheel on the hub and automatically locks it there. Thereafter the emergency wheel becomes a working wheel of the car. While the wheel with the flat continues to turn, its tire is held safely off the pavement.

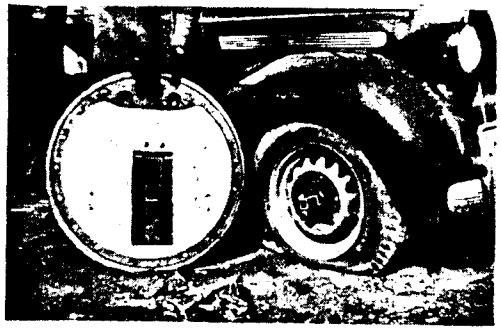
Behind this emergency disk wheel is a regular wheel with a flat tire. The car will run perfectly on it



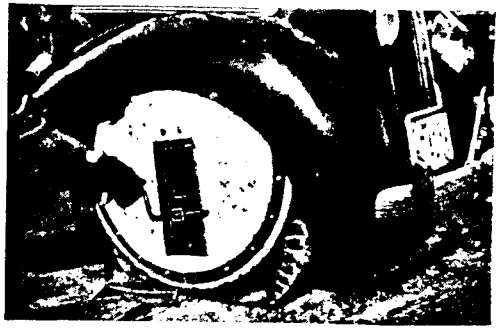
How it is used: The thin emergency wheel is removed from the trunk where it is stored with the spare . . .



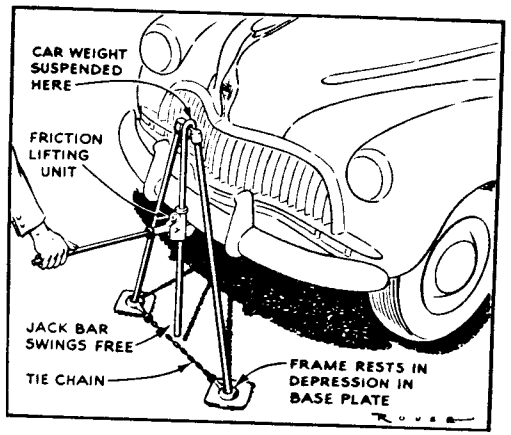
. . . and the hub cap is taken off wheel with the flat. Note the square-ended hub held on by wheel studs



Square hole in sliding panel of emergency wheel is fitted over square-ended hub. When locked on . . .



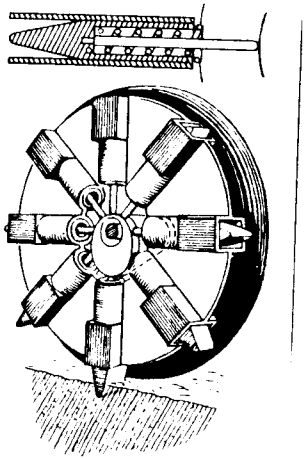
. . . the car is ready to roll again. First half turn of wheel lifts flat and centers emergency wheel (top)

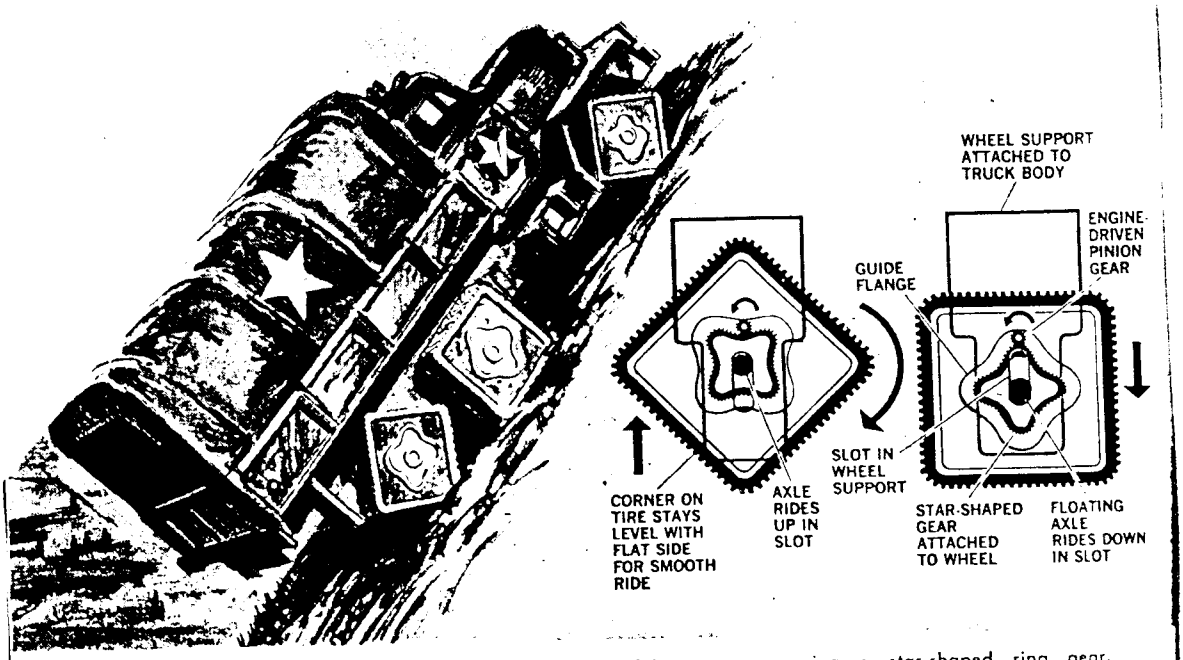


NEW BUMPER JACK. Using a suspension point that is substantially higher than the point of contact with the car, a bumper jack produced by the Johns Manufacturing Corp., of Dunellen, N. J., consists of a steel A-frame on which rests a free-swinging jack bar with a friction lifting unit. This construction is said to give excellent stability, since the bar is free to swing in any direction and compensate for any lateral movement of the car due to changes in the spring suspension while the car is being lifted.

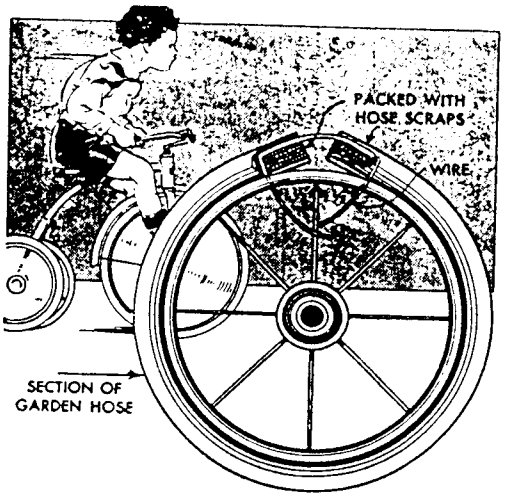
DEC. '41

EXTRA TRACTION for heavy trucks and farm tractors may be obtained at will, through an attachment for a pneumatic-tired wheel designed by Sam R. Johnson, of Altamont, S.D. Lugs spaced around it are normally held retracted by coil springs. When the going is hard through mucky ground, however, the driver operates a control that sets the lugs in action. One after another, they emerge from their sockets to give a toehold in the earth, and then withdraw at the top of the wheel's revolution. This reciprocating motion makes them self-cleaning. To obtain it, the lugs are forced outward against the tension of their springs by piston rods in contact with a fixed, eccentric cam, as shown in the illustration. .





1. SQUARE WHEELS WORK BETTER than round ones in this system for use on rough terrain. The sharp-cornered treads dig in on snow, mud, sand or steep grades, providing increased traction for trucks, tanks and other military vehicles. At the same time, ingenious self-leveling geometry provides a smooth ride on even surfaces. Each wheel is driven by a pinion gear engaging a star-shaped ring gear. Mounted on a floating axle, the wheel automatically rides upward as the corners approach the ground and downward as the flat segments come around. This produces the effect of a round wheel with all parts of the tread equidistant to the ground, thus permitting the use of high speeds on a level terrain



Garden Hose Makes Sturdy Tires For Wagons and Tricycles

Tires for wheels of children's wagons and tricycles can be made from lengths of garden hose. First drill two small holes in the rim equidistant from a spoke and fit the hose to the rim so the ends will meet. Then mark and cut holes in the hose corresponding with those in the rim. Finally, insert wire in the ends of the hose after the openings have been plugged with scraps, pull the wire through the holes in the hose and rim, and twist it to draw the tire tight.

Fred Pennoyer, Bremerton, Wash.

¶Glass tumblers that have stuck together may be separated by putting cold water in the top one and setting the bottom one in warm water.