A NEW SPEED INDICATOR FOR MARINE PROPELLERS.

When the steamship "Perry G. Walker" collided with the lock gates at Sault Sainte Marie, causing the wreck of two other steamers and doing damage to the locks which required weeks for repair, the captain stated under examination that he had signaled to his engineer to go astern, but that his signal had somehow been misunderstood, and the engines had started full-speed ahead. Such an accident is conclusive and incontrovertible evidence of the need of a reliable system of indicating the direction and speed of rotation of the propellers of vessels. It is but one instance of a chapter of marine accidents occurring annually from either the incorrect interpretation of signals given to the engine room from the bridge or the execution of signals given by the bridge which, owing to mental stress from impending accident, are incorrectly given. It is always extremely difficult for a board of inquiry to determine just with whom the error lies.

In the above instance, it is claimed by the captain that the correct signals were given, but instead of the engines being reversed at the critical moment, they were sent ahead; and before the error was discovered, such headway had been gathered by the vessel as to preclude all hope of stopping her within the limited lock space.

There is no question of the importance of enabling the captain and pilot to be at all times familiar with the interpretation and execution of signals. Errors are thereby immediately discernible, and correspondingly corrected before damage is done.

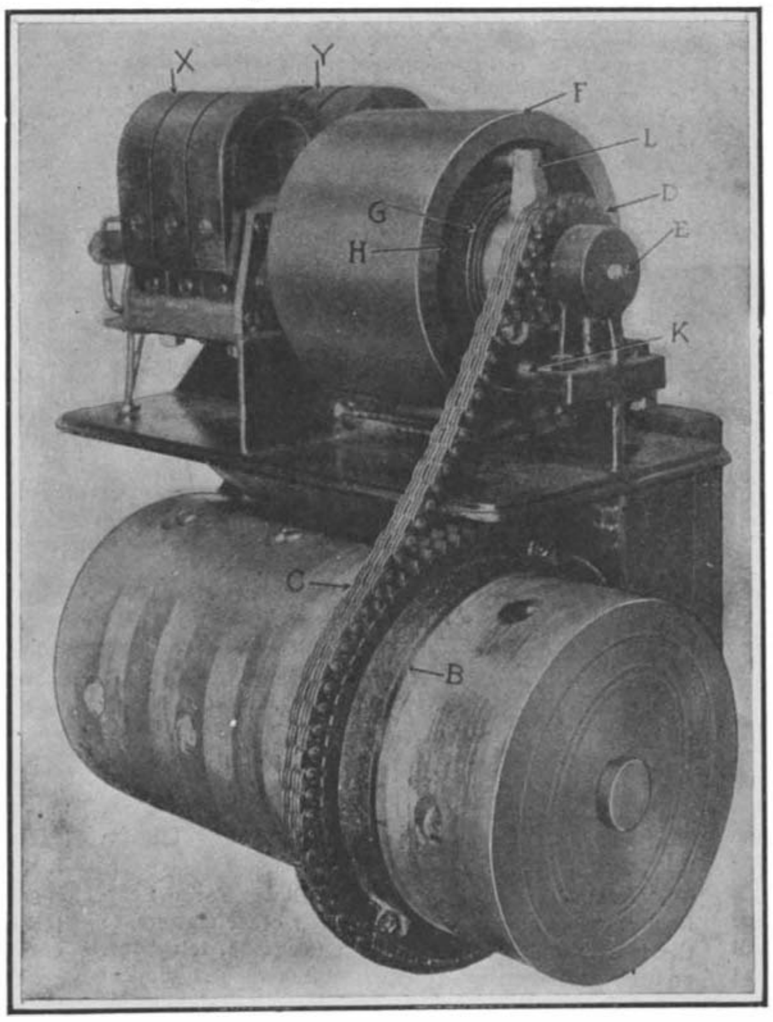
In the absence of a tachometer to show at a glance the rate in revolutions per minute at which the propeller shaft is turning, signals are executed by the engineer according to his best judgment. For instance, the execution of "half speed astern" may vary eight or ten revolutions per minute, and the pilot, depending upon a speed-checking effect, may be thrown off in his calculations by too slow a rate of turning of the engines.

When equipped with a tachometer system, however, the signals can be obeyed at an exact predetermined propeller-shaft speed, with corresponding increased accuracy and efficiency of handling the vessel. Warships in line or column formation must correctly execute the orders of the flagship, setting their speed to conform to the desired headway between ships, quickly and accurately. Otherwise a collision is probable.

The absence of an accurate and dependable tachometer up to the present, has made it necessary to arrive at the revolutions per minute by noting the turns successively by the revolution counter for preferably at least a half minute. If the speed of the shaft is too high, a rough guess must be made as to how much the throttle is to be closed, and another counting gone through. All this takes time, and is on too much of a cut-and-try system. With a tachometer to guide him, the man at the throttle has but to operate the throttle until the pointer of the tachometer rests on the desired R. P. M.

Range finding, for the accurate sighting of the guns, includes the determination of the distance of the object to be fired at, angle at which the warship is approaching or receding from the target, and the speed at which the vessel is traveling.

The first two factors are quickly and accurately determined by means of the modern range finder in the hands of skilled men, located on the masts or range towers of the warship. This is telephoned to the fire control sub-station. It then becomes imperative that the rate at which the engines are turning over at that instant be immediately determined, in order that the proper instructions may be telephoned at once to the turrets. The sooner the discharge of the projectile is effected after the range has been determined, the more accurate is the aim, and the greater the execution done.



A NEW SPEED INDICATOR FOR MARINE PROPELLERS.

In these calculations, the effect on ship speed by propeller speed, taking into consideration the extent and direction of wind and tide, is quickly and accurately calculated.

Relation between ship speed and propeller speed is frequently calibrated with due reference to increased fouling of the ship's bottom from marine growth, and is immediately available. Even when the engine-room forces are endeavoring to maintain an exact prearranged speed of rotation, this speed often varies, owing to the absence of accurate deadbeat tachometers for indicating at all times the rate of revolution.

Aside from the strategic advantages of a tachometer for indicating engine speed of rotation, the economic

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POWERFUL HOISTING AND CONVEYING MACHINE.

Nowhere in the field of mechanical engineering has American ingenuity in the design of labor-saving plants been shown to more striking effect than those great hoisting and conveying plants, which are such a prominent factor in our modern constructive and industrial operations. The rapid and cheap raising, removal, distribution and deposit of materials in large bulk is one of the most serious problems of the day; and it is the ingenious solution offered by American hoisting and conveying apparatus that has enabled our engineers to dig canals, build embankments, handle enormous loads of coal, iron ore, wheat, and corn with an economy undreamed of in an earlier day. We present illustrations of a powerful electric bridge tramway, designed and erected by the Brown Hoisting and Machinery Company for the Michigan Alkali Company, which is an excellent sample of the type of machinery above referred to.

The bridge, which is designed to handle the limestone in the stock yard of the company, has a span of 256 feet from center of pier to center of shear, with the center depth of 17 feet, and the total over-all of the structure is 286 feet 4½ inches. The height from top of rail to top of bridge at the shear is 59 feet 9 inches, and at the pier 61 feet 9 inches, the bridge being level. To the bridge span and its projection is attached a runway carrying a special trolley, arranged to handle either a two-rope grab bucket or a scraper bucket.

The pier consists of two specially designed shear legs mounted on a portal structure, arranged to straddle over two lines of railway track. The two shears are joined together at the top by a yoke connection, designed to carry the bridge structure. By this arrangement a free opening is allowed for the passage of the buckets through the pier support. The structure of the pier throughout is of medium open-hearth steel. The portal or lower portion of the pier consists of two pairs of legs joined together by girders and braces, and arranged to carry a bin for the reception and distribution of the limestone. The lower portion of the portal is mounted on four two-wheel equalizing trucks. These wheels are connected by bevel and spur gears to the driving machinery in the house on the bridge. The shear-leg support is of A-frame construction, mounted on two-wheel equalizing trucks, arranged to run on a single line of rail. At the top of the shear is a ball casting, upon which the main bridge is hung. The track wheels are connected with the moving gear in the engine by bevel and spur gears.

The bridge span consists of two parabolic pin-connected trusses, supporting the cross beams, from which the track stringers are suspended. The bridge span is supported on the pier support by roller bearings, and held in place by a vertical center pin. At the shear support it is hung from a ball-and-socket connection, in such a manner that the bridge may be skewed in either direction from its normal axis, so as to give an angle of one foot crosswise to nine feet lengthwise of the bridge span. The moving gear is operated from the main operating mechanism located

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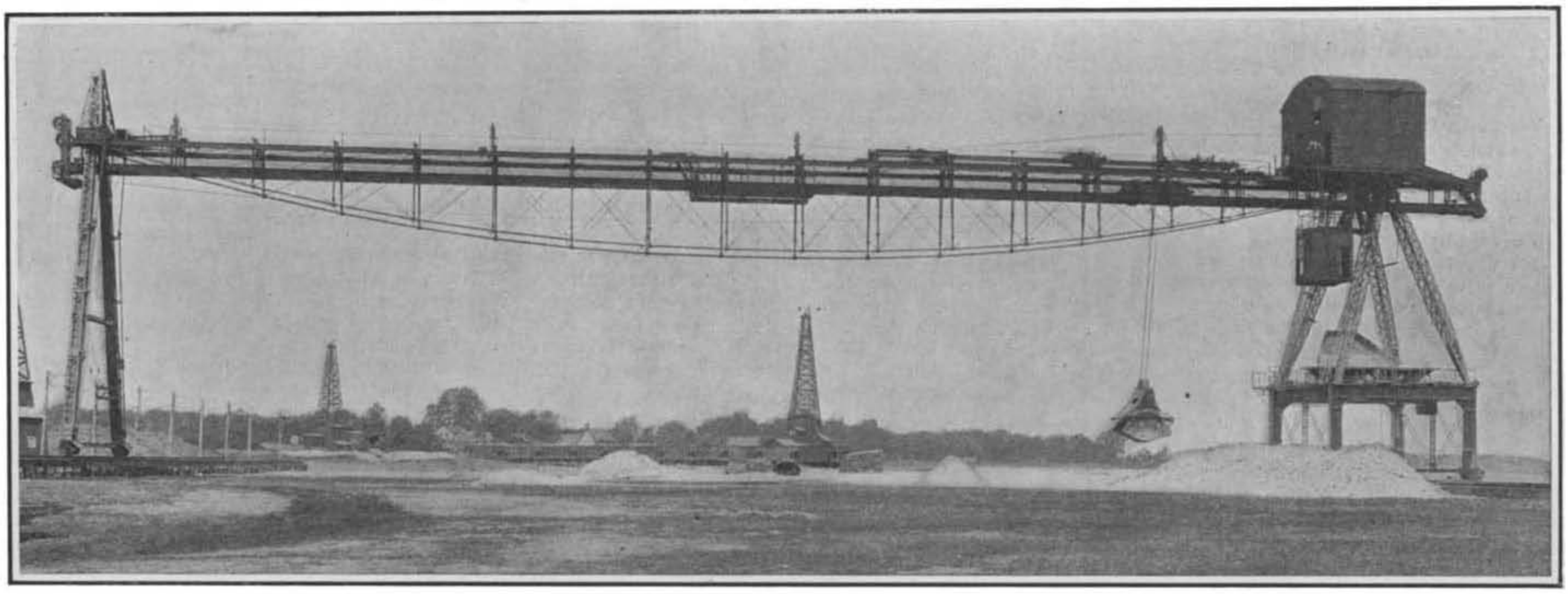

Length over all, 286 feet 4½ inches; depth of trusses, 17 feet; height of bridge above ground, 61 feet 9 inches.

Hoisting and conveying machine; capacity 200 tons per hour.

POWERFUL ELECTRIC HOISTING AND CONVEYING MACHINERY.

Concrete post. E. U. Down.................. 931,396
Concrete post. H. H. Johanning............ 931,616
Concrete reinforcing bar, J. M. Dudley...... 931,185
Connection for co-operating members, flexible, J. E. Webster.................. 931,165
Container, safety. W. Asbury.............. 931,370
Control switch and system, H. D. James, 931,126, 931,205
Conveyer, cross, C. L. Gardner............ 931,054
Cooker, steam, F. C. Roberts.............. 931,088
Cookers, food tray for steam, M. A. Warner 931,533
Cooking utensil, I. E. & R. Q. Lincoln...... 931,209
Corn cabinet, seed storage, S. Babcock.... 931,669
Cotton folder, F. Phelps.................. 931,474
Coupling, J. G. Zimmerman................ 931,173
Croquet arches, socket post for supporting, H. B. Collier 931,568
Cross tie and rail clamp, metallic, H. S. Kilbourne 931,622
Crossover, removable, C. B. Ryan.......... 931,493
Cultivating attachment, C. S. Norcross..... 931,333
Cultivator swivel wheel attachment, S. Seitner, Jr. 931,504
Culvert flexible joint. J. Doyle............ 931,581
Current motor, variable speed alternating, R. D. Mershon 931,136
Current rectifying apparatus. R. P. Jackson. 931,124
Currents having limited strength, process and apparatus for producing, M. M. Osnos 931,336
Cutter thimble for grape and other picking, A. M. Southworth 931,511
Cutting off machine. L. D. Davis.......... 931,043
Cycle change speed and back pedaling brake mechanism, C. T. B. Sangster......... 931,656
Damper regulator, G. Steele.............. 931,095
Deodorizer, C. E. Blood.................. 931,029
Depth gage, L. B. Benton................. 931,253
Derrick platform and turntable, J. W. Page 931,703
Desk, R. T. Jackson, Jr.................. 931,311
Dish, butter, F. Schille.................. 931,497
Dock, dry, L. M. Cox..................... 931,182
Door attachment, screen, A. R. Gordon.... 931,411
Door closure, J. Newsam.................. 931,701
Door, double action double, W. P. Armstrong 931,247
Door, grain, G. S. Ney.................. 931,467
Door hanger, flush, G. Fristad............ 931,052
Door lock, W. S. Clawson................ 931,567
Door, storm, F. A. Schureman............ 931,502
Douche pan protector, E. Reynolds......... 931,219
Draft ventilator, B. E. Cummings.......... 931,183
Draw gear apparatus, J. F. Courson........ 931,682
Drawbridge gate, automatic, A. Lichtfuss.. 931,439
Dress shield, E. N. Gillard.............. 931,591
Drier, W. E. Koop....................... 931,695
Drilling machine, stay bolt. J. Hocking.... 931,119
Drop light bracket, adjustable, P. L. Tenney 931,162
Drying and heating apparatus, L. Turk.... 931,098
Dye and making same, anthracene, F. Kacer 931,618
Dye and making same, sulphur, L. Haas.... 931,598
Dye, azo, L. Hesse, et al.........931,423, 931,424
Dynamometer, F. N. Connet............... 931,274
Edge protecting clamp, G. Stiehle......... 931,233
Electric ground clamp, F. Stevens......... 931,706
Electric machine connection board, J. G. Crawford 931,573
Electric machine, dynamo, J. D. Forrer.... 931,116
Electric machine, dynamo, B. A. Behrend.. 931,375
Electric machine, dynamo, E. Mattman.... 931,448
Electric machine, dynamo, Balcome & Freier 931,556
Electric machine, dynamo, F. E. Hirt 931,606
Electric machine, dynamo, W. S. Kelley... 931,620
Electric machines, winding for dynamo, H. C. Specht 931,156
Electric motor, H. C. Grant.............. 931,416
Electric signaling. J. Mladek............. 931,632
Electric time switch, J. & J. Jones, Jr.... 931,617
Electrical appliance, J. S. Stewart........ 931,518
Electrical distribution system, B. Frankenfield 931,404
Electrode, H. Specketer 931,513
Electrode, arc lamp, G. M. Little.......... 931,133
Electrode, arc lamp, S. P. Wilbur......... 931,169
Electromagnet coil construction, A. A. Low. 931,445
Electromagnet coil construction, Wohl & Hertzberg ....931,540 to 931,542
Elevator. See Pneumatic elevator.
Elevator, W. E. Courtney 931,570
Elevator car and well door operating mechanism, H. Rowntree 931,224
Elevator gate automatic latch, automatic, Gilson & Beattie 931,693
Elevator mechanism. safety. H. O. Barnes.. 931,175
Elevator safety device, E. E. Moulton..... 931,211
Emulsion and producing the same, J. Stockhausen 931,520
Engine electrical interrupter, explosive, G. Honold 931,065
Engine electromagnetic igniter, explosion, G. Honold 931,066
Eraser holder. C. Frederick 931,405
Ether. santalol, J. Callsen, reissue....... 13,008
Exercising apparatus, P. S. Medart....... 931,699
Exercising device, A. Day................ 931,394
Explosive engine, W. F. Beaton.......... 931,176
Fabric, E. H. Outerbridge................ 931,469
Fanning mill, L. O. Hage................ 931,060
Fastening device, Layman & Bouthillier... 931,131
Fastening, self-locking, G. Adams........ 931,665
Faucet, R. Bell 931,252
Faucet, J. P. Urbanek 931,528
Feed regulator, Hall & Holmes....931,195, 931,196
Feed water heater, W. S. Ferguson....... 931,040
Feeding harnessed draft animals, W. H. & J. H. Granbery 931,596
Fence clamp, woven wire. W. N. Squires.. 931,516
Fence construction, W. M. Rankin........ 931,486
Fence post, R. Toennes 931,236
Fence post. F. E. Saunders.............. 931,495
Fences. wire entanglements, etc., standard or support for wire, L. Andersen...... 931,554
Filter, E. Burt 931,267
Filter. Pendergast & Hinsley............ 931,472
Filtering bed. P. F. Bussman............ 931,032
Fire alarm. automatic. P. Bonini......... 931,377
Fire alarm keys, device for holding, A. & A. Iske 931,123
Fire escape, E. J. Cooke................ 931,040
Fire escape, G. W. Brooks............... 931,031
Fire escape, traveling. L. Otter.......... 931,702
Fire extinguisher and other air pressure liquid ejecting vessel. H. T. Blake..... 931,255
Fire extinguisher. automatic stationary, W. Esty 931,190
Firearm. W. L. Marble................... 931,328
Firearm. revolving. O. W. Ringqvist...... 931,146
Fishing rod, E. H. Crane................. 931,277
Flatiron, G. H. Heindselman 931,198
Floor scraper, F. J. King................. 931,432
Floor scraper, F. F. Hase. reissue........ 13,011
Flue collar and pipe supporter, adjustable. A. L. McElvain 931,213
Flushing apparatus. C. A. Wulf........... 931,546
Folding machine, R. C. Seymour.......... 931,230
Folding table, J. A. Keck, reissue......... 13,013
Fork and spade fulcrum attachment, S. L. Conde 931,387
Friction block or shoe, C. C. W. Simpson.. 931,093
Furnace, J. Caygill 931,565
Furnace, W. C. Wilbur................... 931,663
Furnace feeder, L. P. Bolander........... 931,258
Furnaces, firing, G. L. Prentiss........... 931,645
Furnaces, flame indicator for, F. Gelstharp. 931,594
Furniture, convertible, F. H. Henning...... 931,304
Fu joining. R. Theuerkauf 931,235
F inclosed. F. P. Poole......931,476 to 931,478
Game table. J. L. Patton................. 931,470
Garbage and like can. H. C. Buchmaier.... 931,266
Garment, W. S. Barker 931,248
Garment sleeve, J. G. Hochtuhl........... 931,711
Gas burner, W. G. Frazeur............... 931,051
Gas burner, H. Ruppel................... 931,654
Gas engine, A. S. Krotz.................. 931,319
Gas engine, C. T. Wade.................. 931,531
Gas generator. N. Goodyear.............. 931,293
Gas igniting device, electric, H. Jameson.. 931,427
Gas producer, F. Muller.................. 931,460
Gas purifying apparatus. F. Sepulchre..... 931,229
Gaseous fumes or smoke, treating corrosive, C. B. Sprague 931,515
Gear. change speed, P. Evans......931,288, 931,289
Grate, J. W. Webb....................... 931,534
Grate, electrically heated, Hermansen & Tygerson 931,605
Grease cup, A. F. Taylor................. 931,659
Grinder head. Puffer & Hayes............. 931,483
Grinding mill, G. S. Emerick............. 931,045
Grinding mill, W. R. Cunningham......... 931,279

A NEW SPEED INDICATOR FOR MARINE PROPELLERS.

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function enters largely. Each marine plant has its most efficient cruising speed, and in the case of cargo-bearing merchant marine vessels, every pound of coal saved means increased earnings, also increased cruising area to warships. When this economical speed had been determined, with a tachometer system consisting of a plurality of indicators distributed about the vessel to guide, the engines can be kept at this rate of speed accurately and with but slight effort. The captain, in his cabin or on the bridge, the chief engineer when off duty—all can keep track of exactly what rotation speed is being maintained.

The accuracy of dead reckoning is greatly facilitated by an exact knowledge of what engine speeds have obtained during stated and frequent intervals of time, instead of having to take the total number of revolutions over a protracted period and guess roughly at the distance traveled; because the distance traveled per minute by the ship at say 100 R. P. M. is not increased in proportion when 125 R. P. M. obtains. Therefore, during long periods the rate of speed of the shaft may vary considerably with no tachometer to guide the man at the throttle.

Efforts along this line have been made for a number of years, but have been productive of no dependable and accurate device prior to the invention of the system which is the subject of this article.

Centrifugal devices are not susceptible to mechanical transmission to various remote parts of the vessel, and lack extreme accuracy over protracted periods of operation. Pneumatic devices, operated by air-pumps actuated by the propeller shaft, are less accurate. Electrical tachometers have failed in accuracy heretofore because of the error introduced, and varying from day to day, by rubbing or abutting contacts becoming foul, thereby introducing a resistance in the circuit with corresponding inaccuracy of reading of a voltmeter operated by the dynamo, calibrated in R. P. M. of the propeller shaft. Owing to the former use of direct-current instruments, commutators and brushes were necessary on the magneto. The spring tension of these brushes varied, the commutator became oxidized and covered by oil from the bearings, and considerable error crept in. As a warship going ten knots per hour with engines turning over 72 R. P. M. is not traveling ten knots at 71 or 73 R. P. M., it is seen that a tachometer, to be of value, must be accurate to a fraction of a revolution, and maintain its calibration.

All reciprocating engines, owing to the use of connecting rods between the crank and the piston, impart rotation to their shafts of constantly varying angular velocity. The fewer the number of cylinders or the slower the speed of rotation, the greater this variation. These variations are smoothed out more or less by the flywheel on the stationary engine, but a marine engine has no flywheel except a propeller, the weight of which is not sufficient to possess flywheel action to any extent. Therefore, any tachometer actuated by the propeller shaft by gearing or otherwise, has imparted to it an unsteady rate of speed. If the tachometer is geared up to the shaft so that it will rotate faster than the shaft, any momentary irregularity in the revolution of the main shaft is multiplied in the tachometer proportionally to the ratio of gearing between the main shaft and the tachometer. Therefore, whatever indicating device is used in connection with the tachometer will pulsate, and the reading of the pointer on the scale of the instrument will be largely a matter of guesswork between two values of low and high. Hence it is evident that some sort of compensating device must be used to take up these momentary fluctuations of the propeller shaft, and impart to the generator of the tachometer a steady av-

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Grinding mill, S. Lieberknecht............ 931,321
Hame connection, J. A. McClellan........ 931,461
Hame fastener, W. L. Roper............ 931,652
Hammer, fluid pressure, L. E. Howard.... 931,609
Handle loop, W. S. Maxwell............ 931,698
Harvesting machine, grain, J. B. Deeds.. 931,575
Hay hook, Pennington & Chilton........ 931,339
Hay loader, S. M. Wixcel............ 931,109
Head rest, W. P. Clugsten 931,181
Heater. See Feed water heater.
Heater, C. H. Henzel.................. 931,422
Heating apparatus, hot water. O. Oster.... 931,337
Heating device, orchard. F. E. Barney.... 931,557
Heating system, J. Collis.............. 931,037
Heating system, car, E. H. Gold.......... 931,595
Heel for boots and shoes, composite, E. C. Leahy 931,438
Heel protector for rubber shoes and the like, metal, F. W. Boxer............ 931,261
Hinge, W. S. Maxwell.................. 931,697
Hinge and bracket, combined, L. Bertrand. 931,028
Hinge, pintle, F. Meyer 931,630
Hitching device, E. L. Harmer.......... 931,419
Horn, amplifying, W. Tatelbaum........ 931,161
Horseshoe, C. T. Humes.................. 931,067
Hose, flexible metallic, W. Schulz........ 931,091
Hot air wall pipe, J. W. Zuch............ 931,174
Hub, wheel, G. H. Du Bois............ 931,283
Hydraulic power apparatus, A. C. Ferguson 931,402
Incubator, Perkins & Davis.............. 931,142
Indicator, H. P. Quick 931,484
Induction motor, R. E. Hellmund.......... 931,302
Ink supplying apparatus, M. M. Buckler.... 931,560
Insulator for electric wires, A. V. Siler.... 931,507
Insulator, section, H. B. Clarke 931,385
Internal combustion engine. E. A. Rundlof. 931,346
Internal combustion engine, G. L. Crook.. 931,389
Ironing table, W. T. Potter.............. 931,217
Jar, G. T. Barr, Sr. 931,672
Jarring machine, W. Lewis (reissue)...... 13,012
Jetting mill, W. Adams 931,021
Jewel setting. H. Hess.................. 931,300
Journal box lid, C. A. Lindstrom........ 931,442
Kneading machinery, W. H. Rippin...... 931,087
Knives, making table, C. E. Peck........ 931,471
Knuckle opener, F. H. Wendt 931,708
Knuckle opener, car coupler, F. H. Wendt. 931,709
Ladder, step ladder, and scaffold, combined extension, P. Bucco 931,265
Lamp, L. Schepmoes 931,496
Lamp, arc, S. P. Wilbur 931,168
Lamp burner, Paul & McGinnis 931,642
Lamp chimney, W. S. Wiley 931,538
Lamp lighting and extinguishing system, gas, A. Grossmann 931,412
Lantern burner, A. F. Prahm 931,342
Last, E. Y. Austin 931,372
Lasting machine, second, H. F. Loewer.. 931,443
Latch, gate, T. R. Varnell 931,163
Leech, vacuum, J. E. Walter 931,102
Lens, bifocal, E. A. Covelle 931,571
Light protector, W. H. Geddes 931,407
Lightning arrester, W. E. Butler.......... 931,033
Lightning arrester, W. Gifford 931,408
Limekiln, R. Buder 931,180
Liquid fuel supplying apparatus, F. Rademacher 931,647
Litharge, making, J. E. Sullivan 931,522
Load binder, R. L. Boyd 931,710
Lock, J. Blaszczyk 931,256
Lock, L. J. Harris 931,603
Locomotive ash pan, J. S. Downing........ 931,580
Logging apparatus, J. H. & M. H. Dickinson 931,576
Loom, haircloth, G. S. Cox........931,276, 931,683
Magnesium, electrolytic production of, Seward & Von Kugelgen 931,092
Mail and newspaper box, J. M. Lentz.... 931,696
Mail bag catching and delivering apparatus, H. R. Ladd 931,436
Mail bag delivering and receiving apparatus, W. L. Thompson 931,524
Mail pouch receiving and delivering apparatus for railway cars, etc., C. W. Broughton 931,263
Mailing machine, J. W. Orr 931,639
Mattress, I. J. Weinberg 931,361
Mattress strap, W. W. Allen 931,024
Measuring apparatus, whey and milk, J. Livingston 931,071
Measuring instrument, M. Picard 931,475
Measuring surface areas, machine for, L. O. Ramsdell 931,144
Meat tenderer, M. E. French.............. 931,590
Metal shearing machine, Roesch & Wright. 931,220
Metals, welding, H. Goldschmidt (reissue). 13,010
Metallic material, apparatus for treatment of, G. M. Heskamp 931,599
Metering panel board, A. C. McWilliams... 931,464
Mine door, C. W. Carman 931,035
Mine prop, F. Nellen 931,466
Mining apparatus, M. Goldsmith 931,057
Mirror adjusting device, E. A. J. Germain.. 931,291
Mold ramming apparatus, H. Henderson, 931,199 to 931,201
Motive fluid, producing, H. Maxim......... 931,135
Motor brush holder, H. C. Grant 931,415
Motor controller, H. W. Cheney 931,384
Mower attachment, lawn, O. S. Tuttle..... 931,527
Music leaf turner, H. T. E. Covert........ 931,572
Music recorder, A. Saumell 931,494
Musical instrument, brass wind, C. G. Conn. 931,273
Musical instrument, electrical, G. H. Davis. 931,281
Musical instruments, rotary valve for wind, C. G. Conn 931,039
Nailing machine, J. M. Wiggin 931,107
Negotiable instrument, H. A. Anderson... 931,246
Nut cracker, W. M. Burkle 931,562
Nut lock, C. Girardot 931,409
Optical instrument, C. B. Boyle.......... 931,673
Ore crusher, C. O. Michaelsen 931,210
Ore granulator or pulverizer, J. G. Kirksey. 931,316
Ore reducing furnace, G. F. Rendall........ 931,145
Ore separating apparatus, W. H. Silberhorn. 931,153
Organ, folding, Caulkins & Wienand........ 931,678
Outlet box construction, E. W. Stull........ 931,521
Oven heat regulator, G. A. Stewart........ 931,232
Package fastening member, W. M. Conrad. 931,569
Package tie, E. W. Milhado 931,631
Packing, cinch, R. R. Keith.............. 931,128
Pail, H. E. Kerr 931,315
Paint and varnish remover, L. Ornstein... 931,335
Paint, varnish, and lac, composition for removing dried, R. G. Stewart.......... 931,519
Pan. See Douche pan.
Paper bags, etc., machine for making, A. Darvas 931,041
Paper holder, toilet, F. H. Hoberg.......... 931,118
Paper pasting machine, wall, A. C. Ross... 931,492
Paper shell making machine, J. Chesney... 931,269
Partition or book support, movable, Wheeler & Hilckman 931,362
Pasteurizing holding tank, J. E. Amend.... 931,025
Pavement heating and rolling machinery, bituminous, Prescott & Kerns.......... 931,085
Pegging machine, J. F. Davey.............. 931,042
Penholder fountain attachment, D. O. Vaughan 931,530
Percussion engine, W. Mauss 931,449
Permutation lock, W. Erhardt 931,287
Phonograph needle receptacle, W. E. Watson 931,103
Phonograph records and indexes combined therewith, cabinet for holding disk, W. A. Hobbs 931,426
Phonograph records and other flat articles, holder or case for, A. C. Hafely...... 931,600
Photographic appliance, G. F. Fraley 931,050
Photographic film pack, daylight loading, J. E. Thornton 931,525
Photographic machine, automatic, J. F. Raders 931,485
Piano, automatic playing, French & O'Brien 931,192
Piano pedal, auxiliary, J. Virgillito 931,662
Picture molding, L. Cholet 931,566
Pipe coupling, T. E. Williams 931,171
Pipe coupling, W. H. Hammon 931,296
Planter, potato, P. Bernhardt et al........ 931,178
Plow, E. B. James 931,125
Pneumatic elevator, A. Rosenthal.......... 931,221
Pocket, J. Pensalek 931,473
Pole changer, automatic, Williams & Welch 931,242
Polishing machine, E. Cavicchi 931,383
Post hole digger, T. Hardy.............. 931,061
Potato bug destroyer, A. Lindahl 931,440
Pressure regulating device, O. Onsrud...... 931,334
Prime movers, suspension means for, R. Siegfried 931,152
Printing and similar machines, sheet separating device for, O. Schneider........ 931,227

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erage speed, not affected except by decided slowing up or acceleration of the engine.

A tachometer has recently been perfected by Mr. Mellor Reece Hutchison, in which these defects are avoided by very simple and dependable means.

The accompanying illustration shows a merchant marine generating set of this electrical tachometer, installed in the shaft alley of a steamer.

The large split sprocket wheel *B*, of proper diameter to conform to the shaft *A*, is firmly clamped thereto. A Morse silent chain *C*, engaged by the sprocket wheel *B*, drives a similar sprocket wheel *D* mounted on a countershaft *E*, which forms part of the tachometer generating set. The rotation of this small sprocket is transmitted to the flywheel *F*, keyed to the countershaft *E*, through the intermediary of two opposite coiled spiral springs *G*, *H*. Inside the rim of the flywheel *F*, and on the end opposite to the spiral springs *G*, *H*, gear teeth are cut which engage two pinions. These pinions respectively actuate magnetos *XY*. It is seen that any momentary fluctuation in the rotation of sprocket *D*, occasioned by variations in the angular velocity of the main shaft *A*, are smoothed out by the springs *G*, *H*, imparting to the flywheel *F* and countershaft *E* a steady average speed. To protect the springs *G*, *H*, against rupture from sudden reversal of rotation of main shaft *A*, stop pin *K* is mounted on the flywheel, and engages radial arm *L*, mounted on the sprocket wheel *D*, thereby preventing more than one-half an independent revolution of the countershaft. This one-half revolution is sufficient to take care of practical conditions on marine equipments.

The magnetos *XY* are of the inductor type. The armatures and the pole pieces are stationary. 1 is a permanent magnet of finest steel, properly aged to insure absolute permanence. 2 2 are the pole pieces of soft iron attached thereto. 3 is a stationary shuttle armature, on which is winding 4. Rotating between the pole pieces and the armatures is the soft iron inductor 5. As the inductor is rotated, an alternating electromotive force is generated in the armature, two cycles per revolution.

The magneto is so designed that the voltage is directly proportional to the speed of rotation of the inductor, over a wide range. Therefore, the faster the propeller shaft turns, the higher the voltage directly proportional thereto.

It will be noted there are no commutators or brushes, the armature being stationary and the leading-out wires soldered to the main-line wires. Therefore, no error can creep in from increase of resistance of contacts.

The indicators are alternating-current voltmeters of the dynamometer type, i. e., having a moving coil and stationary coils.

In present practice, however, alternating-current voltmeters read but one way, with the zero on the left of the scale. A tachometer, specially for marine use, must show direction of rotation of main shaft as well as the speed. In the design of this, therefore, the zero is at the center, deflections of the pointer to the left indicating speed of rotation of the propeller shaft astern, and to the right ahead.

The pointer of the indicator is deadbeat at its reading, and is not influenced by the rolling or pitching of the ship. Provision is also made to protect the instrument against concussion or atmospheric disturbance from heavy gunfire.

In the naval type each indicator is entirely independent of all the rest, being connected to its own pair of magnetos; hence, should one indicator be shot away or otherwise damaged, it will not affect the reading of any of the other indicators.

In the merchant marine type, however, this is not deemed necessary, one pair

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Printing press, B. F. Upham 931,099
Printing press punch, adjustable, W. E. Dillingham 931,282
Propeller for boats, drop, F. E. Stribling.. 931,159
Propeller mechanism, collapsible, W. Morgan 931,456
Pump, centrifugal, F. Neumann 931,636
Pump, piston, H. P. Wedin.......... 931,535
Punching machine, W. B. Kilgore.......... 931,431
Push button apparatus, R. D. Burk.......... 931,380
Putting out machine, F. J. Perkins.......... 931,340
Puzzle, H. W. Cadwell 931,677
Rail, continuous, C. E. Weaver 931,104
Rail joint, J. S. Hickson 931,117
Rail joint, T. K. Diehl 931,577
Rail joint, Frederick & Chapman.......... 931,589
Rail joint truss support, L. Mueller.......... 931,459
Railway cattle guard, J. H. Wheeler.......... 931,537
Railway construction, H. C. Grant.......... 931,418
Railway frog, B. J. Morgan 931,073
Railway joint, D. B. Coupland 931,275
Railway overhead line construction, electric, T. Varney 931,354
Railway, pleasure, C. M. Perdew 931,705
Railway signal, B. E. Andress 931,666
Railway spike, C. L. Columbia.......... 931,272
Railway switch, O. C. Jefcoat 931,428
Railway switch, automatic, G. E. Toullerton 931,660
Railway tie, J. F. Schneider 931,226
Receptacle, wooden, H. H. Horr.......... 931,694
Reflector, lantern, O. A. Prunner.......... 931,482
Rein or neck strap line terret, S. E. Harsh. 931,298
Reinforcing bar, A. E. Lindau 931,322
Releasing device, C. Hunt 931,122
Resinous matter, recovering, W. J. Hough. 931,608
Reticule, E. Lazarovich-Hrebelianovich..... 931,627
Reversing apparatus, G. Schulz 931,501
Rheostat, multiple switch, O. S. Schairer.. 931,148
Ring traveler holding and delivering means, J. C. Edwards 931,690
Rivet setting machine, A. R. Havener..... 931,062
Rock drill, W. E. Porter 931,479
Rock drill or boring tool, J. Hutchings.... 931,611
Rod. See Fishing rod.
Rolling mill tube trough, Worth & Harrison 931,543
Rolling pin, H. E. Fendring 931,691
Rotary engine, C. McQuown.......... 931,077
Rotary machine, C. G. Conn.......... 931,038
Routing machine guide device, W. H. Ahlers 931,552
Rubber, ebonite, or vulcanite, manufacturing goods of, O. C. Immisch.......... 931,310
Rubber like gum from its vegetable sources, extracting, F. H. Humcke....931,120, 931,121
Sad iron, self heated, A. H. Davis 931,686
Safety switch, J. T. Krieger.......... 931,208
Sand blast blower, D. A. M. Doublet..... 931,579
Sash lifter, R. Corbin 931,388
Sash lock, J. L. Grether 931,194
Sausage machine, J. Wundrach 931,363
Saw feeding mechanism, H. B. Ross et al. 931,223
Saw frame, flexible, C. Kusch 931,435
Saw set and clamp, F. W. McLean.......... 931,076
Scale, coin controlled beam, W. H. Jordan 931,429
Scarf holder, E. H. Rose 931,147
Seal, J. A. Beauerle 931,670
Seal, car, F. W. Brooks 931,379
Separator, A. J. Morlock 931,457
Sewing machine attachment, C. D. Armstrong 931,369
Sewing machine grinding attachment, G. I. Green 931,597
Sewing machine looper mechanism, F. E. Valois 931,352
Sewing machine, overseaming, A. Grieb.. 931,058
Sewing machine ruffler, W. R. Parsons.. 93 1641
Sewing machine shuttle and accessories, rotary, J. O. Huffman 931,610
Sewing machine work clamp operating device, T. M. McLaughlin and R. R. Hughes, Jr. 931,700
Shade roller bracket, adjustable, C. E. Sprague 931,514
Shaft construction, F. M. Remmek 931,488
Shaft hanger, H. La Casse.......... 931,129
Shearing machine, C. M. Palmer.......... 931,141
Shingle or tile, roofing, F. W. Meyer.... 931,329
Shock absorber, G. Bank 931,671
Shoe and fastener therefor, L. O. Lindberg. 931,441
Shoe, sporting, W. J. Riley 931,343
Sifter, ash, J. Farnworth 931,191
Sifter, ash, J. Markey 931,446
Sign, advertising, J. W. Ellis 931,188
Sign, luminous, P. L. Clark.......... 931,036
Signal, R. L. Cairncross 931,382
Signal device, H. J. Heeney 931,604
Signal system, supervisory, C. F. Patterson 931,704
Silk product and treatment of silk, J. Knup 931,433
Silo packer, G. R. Rogers 931,090
Siphon, S. F. Miller 931,453
Skate, roller, J. H. Hollar 931,064
Skirt trimmer, E. O. Blechschmidt 931,257
Sleeve closure, W. S. Barker 931, 49
Smoothing iron, S. G. Buskard 931,381
Snap hook, T. Forstner 931,588
Snow plow, C. A. Bellrud 931,559
Solder for aluminium, Z. Tamassy 931,523
Sole edge burnishing machine, Z. Beaudry. 931,558
Sole, galvanic, Kennedy & Davis.......... 931,068
Spectacle frames, manufacturing, R. H. Simonds 931,508
Sprayer, D. O. Bowman 931,030
Spraying device air chamber, liquid, A. M. Phillips 931,215
Spring wheel, L. Flum 931,048
Spring wheel, W. H. Wildrick 931,241
Spur, folding, J. D. Hayes 931,063
Stalk cutter, J. A. McKay.......... 931,635
Stamping machine, E. B. Wilhelm 931,170
Steel, method and apparatus for treating, W. E. Nickerson 931,332
Steels for industrial purposes, treatment of, E. Schneider 931,499
Stencil, T. C. Hough 931,309
Stirrup, G. W. Hooks 931,607
Stoker, underfeed fuel, G. Weiland 931,536
Stopper, K. Friedman 931,406
Stopper, B. J. Morrison 931,458
Stove, gas cooking, L. Kahn.......... 931,312
Stove, heating, A. K. Beckwith 931,374
Stovepipe holder, J. N. Queen.......... 931,086
Strainer, R. H. Carlisle 931,564
Strainer or cooker, vegetable, W. Leetten.. 931,070
Street inlet and water closet flush, automatic, odorless, self-cleaning, J. Pratt. 931,481
Structural parts, means for preserving, A. Knapen 931,318
Sugar, producing milk, A. A. Dunham..... 931,584
Sunshade holder, E. H. Atkinson.......... 931,371
Surgical knife, E. Huttmann 931,612
Sweep rake, Brown & Keithly 931,675
Switch key, N. H. Holland 931,202
Swivel hook, W. R. Clarkson 931,270
Syringe, A. Bean 931,113
Tag fastener, Harris & Flood 931,420
Talking machine stylus replenishing mechanism, Beulna & Burson 931,676
Tanks from bursting by freezing, means to prevent, A. Ballard 931,112
Tap, Turner & Digman 931,526
Telegraph and selective system therefor, automatic, A. C. Gilmore 931,055
Telegraph and telephone pole, J. H. Hile. 931,425
Telegraph pole arm, L. Tyreman.......... 931,661
Telegraphy and telephony, receiver for wireless, S. Eisenstein 931,586
Telephone deck stand, J. A. Birsfield...... 931,179
Telephone exchange selector, automatic, F. H. Loveridge 931,072
Telephone exchange switchboard apparatus, J. L. McQuarrie 931,330
Telephone exchange system, measured service automatic, W. W. Leach 931,132
Telephone instrument mounting, H. E. Shreeve 931,231
Telephone key, J. L. McQuarrie 931,331
Telephone service rent collecting means, R. Yearneau 931,547
Telephone system, private branch intercommunicating, J. L. McQuarrie.......... 931,138
Telephone system, private branch intercommunicating, N. H. Holland 931,307
Telephone transmitter, A. G. Kaufman.... 931,127
Telephone transmitting mouthpiece, R. E. Miller 931,452
Threshing machine, H. O. Sageng 931,347
Tie. See Cross tie.
Tie plate, A. L. Stanford.......... 931,517
Time recorder, W. Beresford 931,254
Tire antiskidding device, T. I. Duffy...... 931,284

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of magnetos supplying all the indicators, which are connected in multiple.

A very important fact in Mr. Hutchison's system is the use of an exceedingly small current value and low voltage; hence, in the event of the indicators being located in proximity to ammunition, should the circuit be opened by the breaking of a wire or otherwise, the resultant spark is barely perceptible and cool, therefore incapable of igniting anything. Should the line become short-circuited, no heating effect whatever is produced and no damage done to the magnetos, as they can run for an indefinite time on dead short circuit. No effect is produced on the compass by the current in the wires, and, taken all in all, the system seems to meet every requirement of accuracy and safety.

POWERFUL HOISTING AND CONVEYING MACHINE.

(*Continued from page 156.*)

in the machinery house at the pier end of the bridge, the power from which is transferred to the moving gear wheels by a line of shafting on top of the bridge, thence to lines of shafting down the pier and shear supports, and thence by a proper train of gears to the wheels.

The moving gear mechanism is attached to the operating mechanism by means of friction clutches, so arranged that the motion of the crane may be made in either direction at the will of the operator. Further provision is made for disconnecting the gearing, in order to skew the bridge within the limits given.

The main operating mechanism for the bridge is located in the machinery house, and consists of two drums. Each of these drums is mounted loose on its supporting shaft. Each drum is controlled by a Brown friction clutch and a band friction brake. The drums are connected one to the other through an equalizing gear mechanism, which is equipped also with a powerful foot brake, so that the two main operating drums may be made to rotate in opposite directions with the same speed. This feature of connecting the two drums is one of the all-important points in the Brown two-drum operating mechanism. The main operating machinery is further arranged to operate from the intermediate shaft the bridge crane moving gear mechanism, to which the supporting truck wheels are connected by shafting and gearing. This mechanism is controlled also by a powerful clutch and band friction foot brake.

In further connection with the two main operating drums is a small closing drum which, in conjunction with the two main drums, controls all of the motions of hoisting and lowering the load and traveling the trolley. The trolley, which in reality forms also a part of the main hoisting mechanism, is specially designed to operate in conjunction with the drum arrangement above described. In general, this trolley consists of a steel structural frame mounted on four turned cast-steel track wheels arranged to run on the trolley runway of the bridge crane. In the trolley there are mounted specially-designed drums, which run loose on their supporting shafts. The large section of each drum is connected to the main hoisting drums in the machinery house in the following manner:

One length of wire rope will connect, from the under side, one of the main hoisting drums to the top side of one of the large sections of the trolley drums. The under side of this trolley drum is connected by wire ropes to the top side of the other main hoisting drum. The top side of this same hoisting drum is connected by suitable cable to the top side of the other trolley drum, and likewise this trolley drum from the under side is connected to the underside of the other main hoisting drum. By this arrangement of ropes, if one of the main

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