New Electric Drive Improves

A trunnion-type, single-leaf bascule lift span at Wallaceburg, Ontario, differs in appearance very little from other lift spans of this type throughout Canada and the U. S. But it is significantly different.

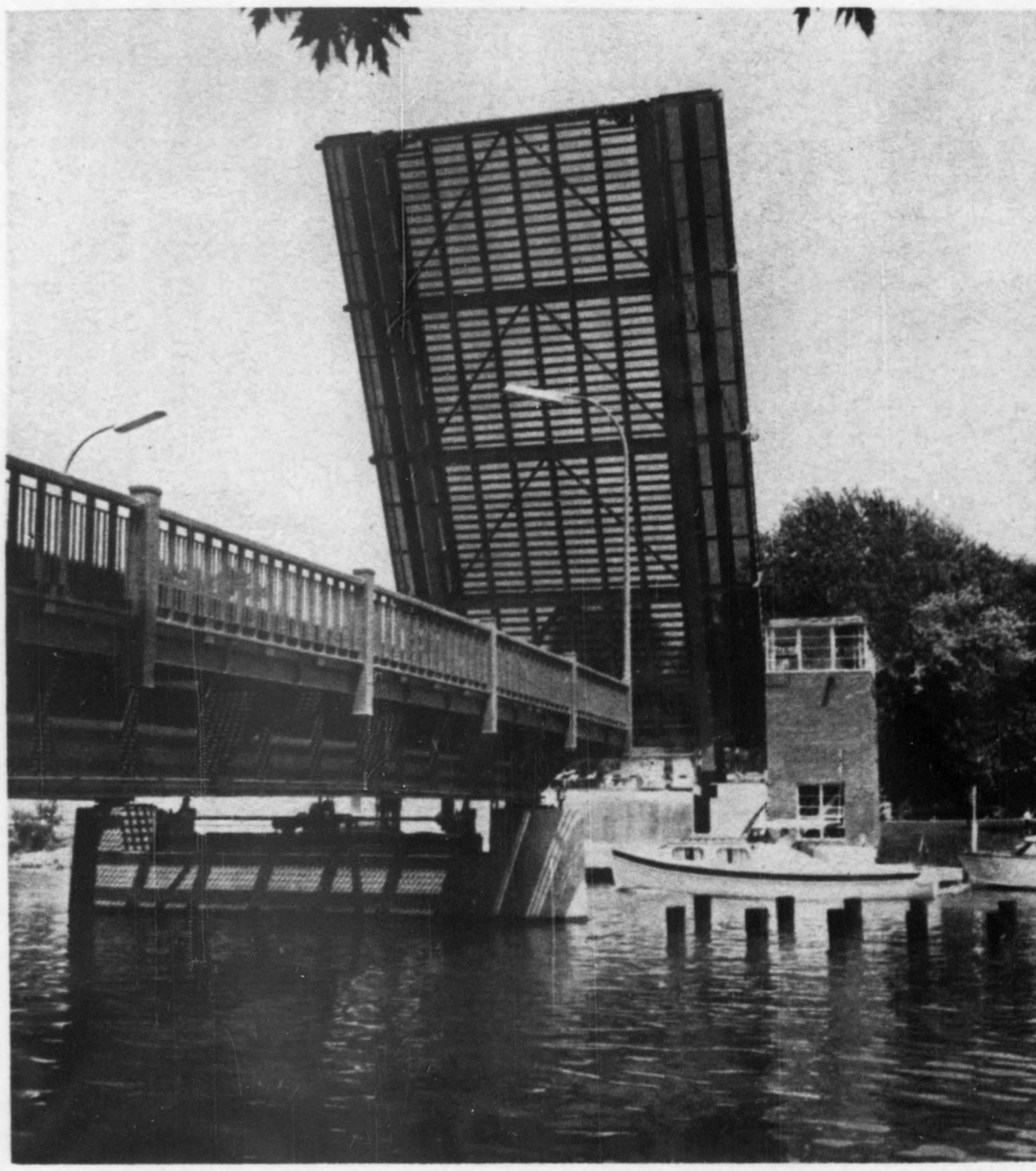
Dominion Bridge Co. of Montreal designed it with a new concept for the electric drive. Named the "two-motor opposed-torque drive", it is based on principles similar to those employed for electric crane hoists.

The new drive also has been proposed for a swing span in the Montreal area. It will enable remote and automatic operation of an existing manually controlled bridge.

In essence, the opposed-torque drive is an economical method of meeting basic drive requirements for movable-bridge spans by using standard wound rotor motors and control devices. It works without complicated control circuits or components or frictional braking devices, yet conforms with modern bridge practice.

• Strict requirements—Drive specifications for movable spans are exacting. The massive structure must be moved from the closed to the open position and reclosed, stopped gently and accurately in its final position. This must be done under normal operating conditions and the worst possible conditions, during which the span can be subjected to a variety of forces from wind and snow. And movements must be made with a minimum of shock to the moving and fixed structures.

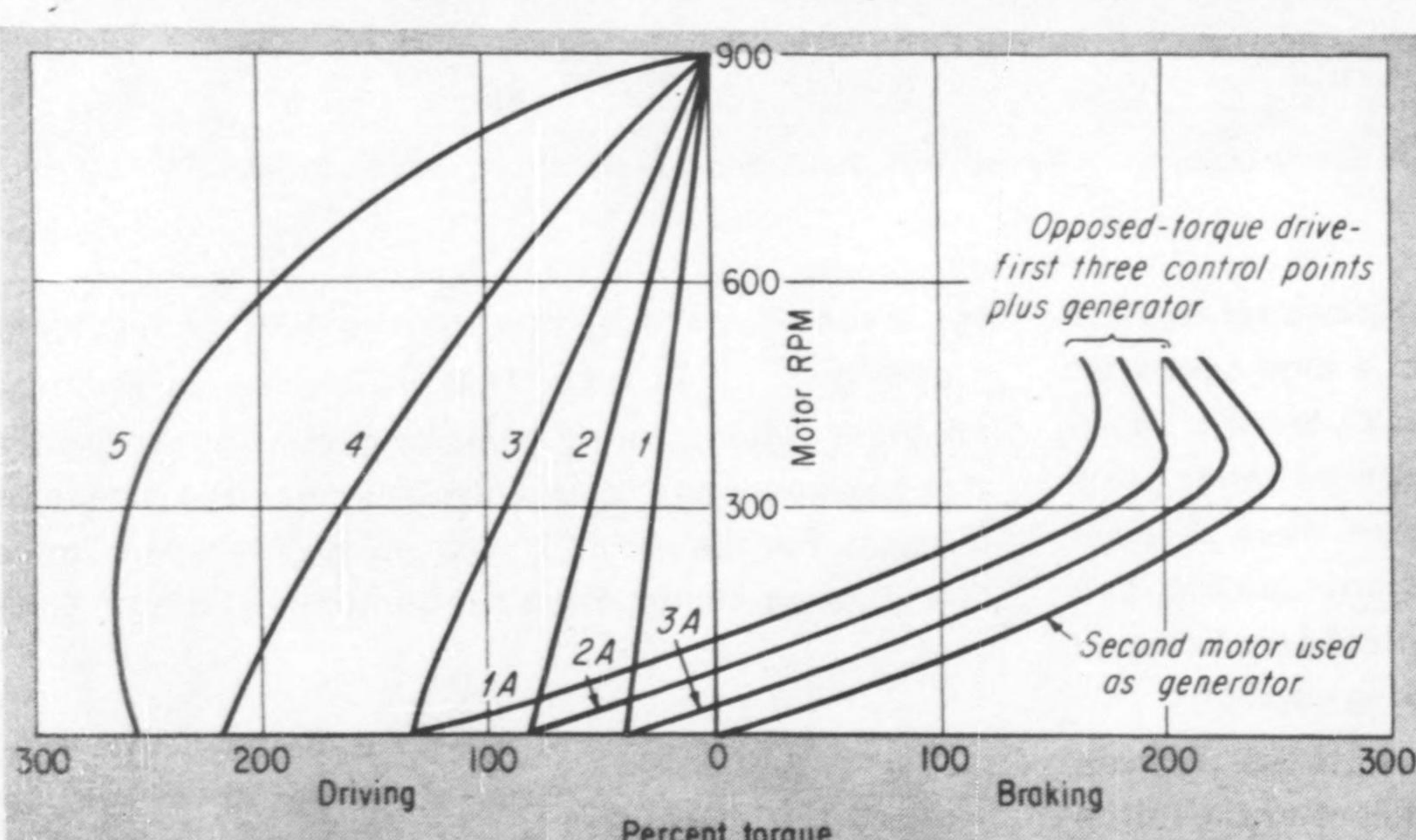
Furthermore, modern bridge practice dictates that a spare motor be coupled to the machinery, ready to run, with provision for manual control, regardless of the type of operation normally in use.



Ontario bascule bridge pioneers with opposed-torque drive.

Lift spans are usually balanced within close limits by counterweights (under normal operating conditions) but are left slightly "span heavy" to assist in seating. Hence, a drive that provides only "motoring torque", such as a wound rotor motor with rotor resistance control, might seem sufficient. But, variable conditions due to snow and wind pressure upset this balance. They can cause the span to overspeed, thus unloading the motor and allowing motor speed to increase correspondingly. For these conditions, a braking torque is required to restrain the motor, thus control the span movement and final positioning.

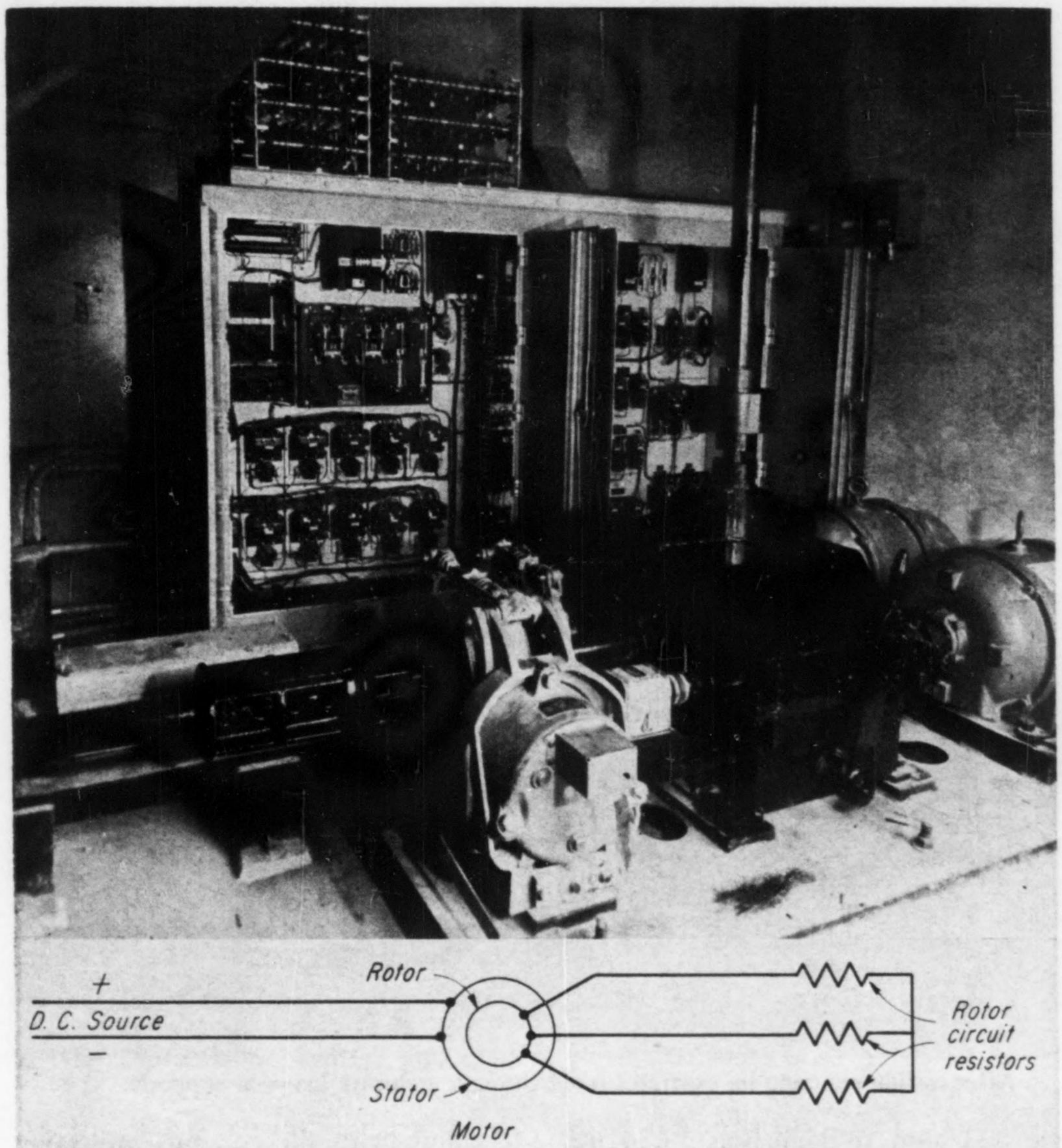
A popular method of providing this torque is to use a frictional device, but the braking effect is variable and results in erratic performance. To overcome this difficulty, Dominion Bridge decided to supply the braking torque from the spare motor.



SIMPLE DYNAMIC BRAKING, with five-point control, supplies fixed direct current excitation to the generator stator. Excessive excitation may be needed for desired braking.

• Simple dynamic braking—In the standard braking system, two motors rotate the lift span. One develops con-

Control of Movable Bridges



Controls include spare motor acting as generator and as a brake.

ventional motoring torque. The other (normally the spare) produces braking torque, obtained by converting the motor into a generator and dissipating the resulting power in a resistor.

This dynamic braking is accomplished by supplying fixed dc excitation to one phase of the motor stator to set up a magnetizing current. At zero speed no voltage is generated, and therefore no braking results. When the motor rotates, a generated ac voltage appears at the slip-rings and produces a braking torque. Increasing with speed, this voltage produces increasing braking torque. The speed reaches a maximum, beyond which no increase in torque can be obtained without an increase in excitation. (Increasing the excitation may cause a motor to overheat.)

• **Compensated dynamic braking**—Dominion Bridge considered the standard dynamic braking system unsuitable for bascule operation because of the wide load fluctuations and varied braking forces needed because of the weather.

Dominion Bridge adopted an improved method, now patented, in which the braking torque increases automatically with increasing speed without danger of injurious motor heating. This is accomplished by compensated dynamic braking—rectifying part of the motor rotor current and feeding it to the stator in parallel with the fixed source of excitation.

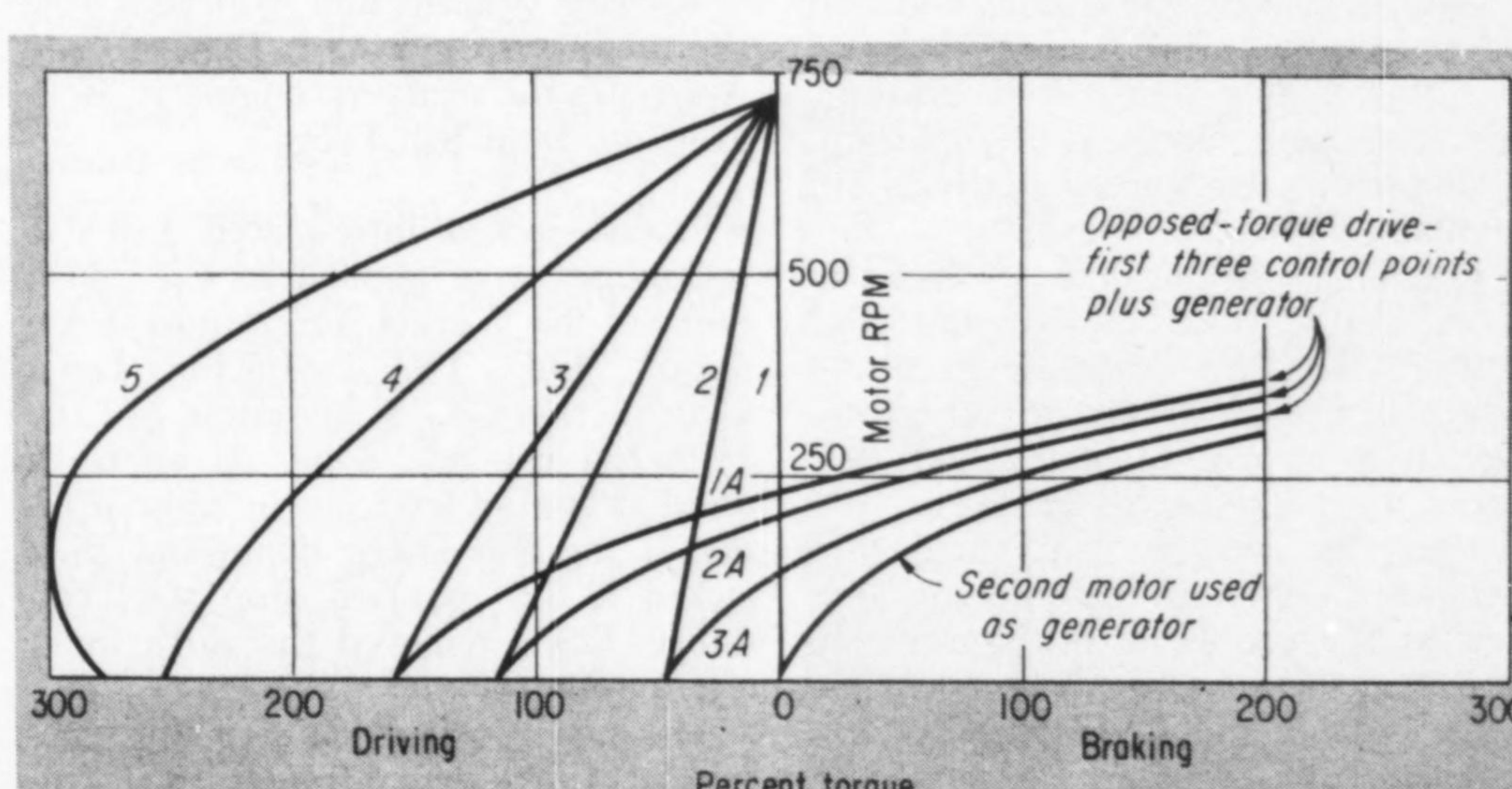
The usual bridge controller gives at least 5-point control of the drive. Three points of the controller switch in the second motor to provide the opposed-torque. Two points revert to single-motor operation as a conventional wound rotor motor to give higher running speeds between the nearly closed and nearly opened positions.

If a motor fails, manual control of one motor can operate the bascule. Manipulation of the service electric brake (normally used for holding purposes) provides braking torque as required.

• **Better and cheaper**—Although the two-motor, opposed-torque drive does not offer all the refinements of more elaborate and costly schemes, it completely fulfills the basic operational requirements. It conforms to the modern bridge practice of providing a second motor, but puts it to work instead of giving it a free ride. It also provides a means for manual control and eliminates the need for a friction device to obtain braking torque.

The new drive is only slightly more costly to install than a friction-brake scheme. But it is superior in performance, simpler to operate and requires less maintenance.

The bridge at Wallaceburg with two 20-hp motors, has just been put into operation. No figures as to operating costs are yet available, but tests reveal that the performance characteristics closely follow the design performance curves.



COMPENSATED DYNAMIC BRAKING rectifies part of the generator rotor current and feeds it to the stator so that braking increases automatically with speed.